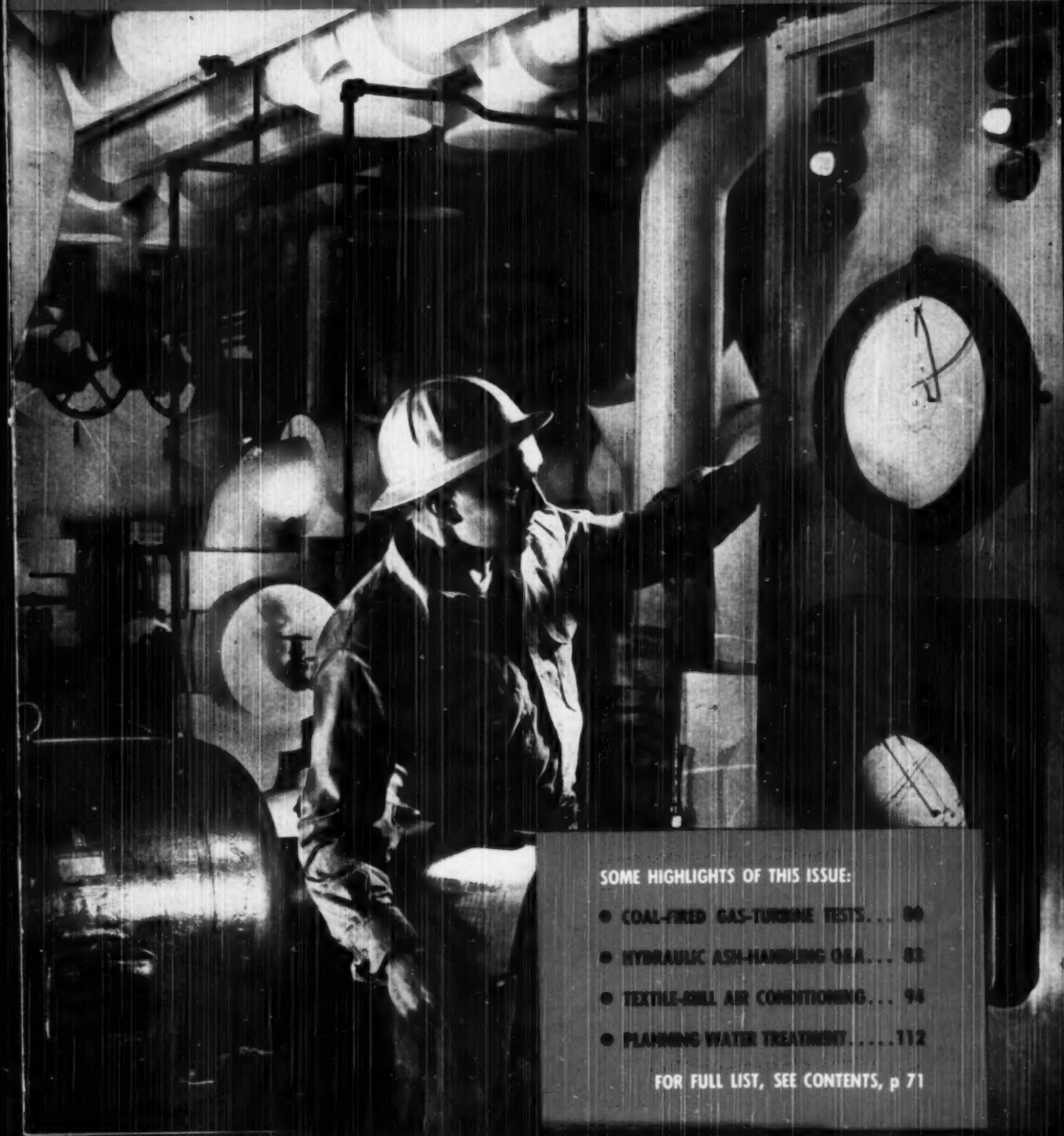
POWER

MAY 1950

A McGRAW-HILL PUBLICATION DEVOTED TO GENERATION, TRANSMISSION AND APPLICATION OF THE POWER SERVICES



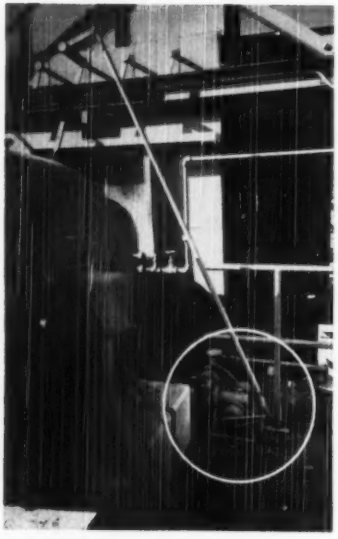
SOME HIGHLIGHTS OF THIS ISSUE:

- COAL-FIRED GAS-TURBINE TESTS... 80
- HYDRAULIC ASH-HANDLING O&A... 83
- TEXTILE-MILL AIR CONDITIONING... 94
- PLANNING WATER TREATMENT.....112

FOR FULL LIST, SEE CONTENTS, p 71

Control panel for one of the 400,000 lb/hr gas-fired boilers at New Orleans Public Service's Industrial Canal Station.

From Btu's to megawatts—
L&N equipment aids plant efficiency



In this semi-outdoors plant, rugged Metermax Electric drive units, like this one (circled) on the induced draft vanes, operate dependably without need for protection from the weather.

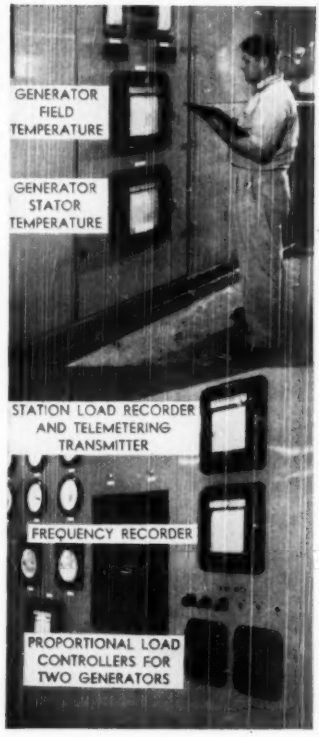
The new Industrial Canal Steam Electric Generating Station of New Orleans Public Service Inc. uses L&N instruments and controls at many steps in power production—from firing fuel to distributing power.

Steam-end equipment includes Metermax Combustion Control; Micromax Superheat Control; Micromax Recorders for temperatures of air, water and steam, CO_2, and for condensate purity. On the electrical end are recorders for temperatures of bearings and generators and for frequency, load telemetering and load-frequency control.

In addition to these, we supply the power industry with recorders for smoke density, pH, flow, a-c and d-c voltage and current, power factor and reactive kva.

If you'd like panel engineering service, we're equipped to design and build complete panels, shipped to you fully assembled, wired and tested, ready for installation.

For details, write to Leeds & Northrup Co., 4910 Stenton Ave., Philadelphia 44, Pa.

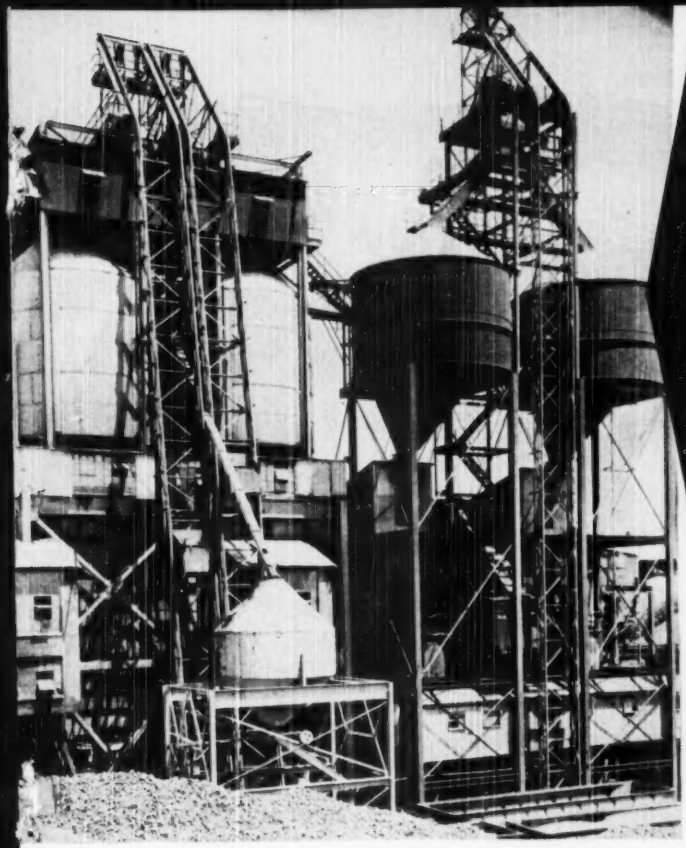

GENERATOR FIELD TEMPERATURE
GENERATOR STATOR TEMPERATURE
STATION LOAD RECORDER AND TELEMETERING TRANSMITTER
FREQUENCY RECORDER
PROPORTIONAL LOAD CONTROLLERS FOR TWO GENERATORS

MEASURING INSTRUMENTS · TELEMETERS · AUTOMATIC CONTROLS · HEAT-TREATING FURNACES

LEEDS & NORTHRUP CO.

Jrl. Ad N-460(4)

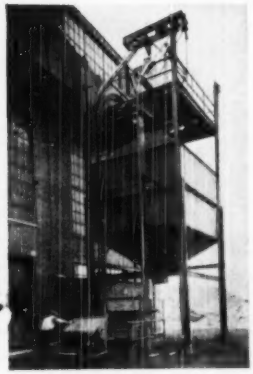
POWER (with which are consolidated "Science and Industry," "The Engineer Review," "The Engineer" and "The Stationary Engineer"), May, 1950, Vol. 94, No. 5. Published monthly with an additional Directory number in June. McGraw-Hill Publishing Company, Inc. Editorial and executive offices, 330 West 42nd Street, New York 18, N. Y. Entered as second class matter January 26, 1949, at the post office at New York, N. Y., under the act of March 3, 1879. Printed in U. S. A. Allow at least ten days for change of address. Subscription rates—U. S. and U. S. Possessions $5 for one year, $7 for two years, 65c per copy. Canada $7 for one year, $11 for two years. Pan American Countries, $10 for one year, $16 for two years. All other countries $15 for one year, $25 for two years. Please indicate position and company connection on all subscription orders.



Low Cost Handling of Fuel and Ashes with LINK-BELT Skip Hoists

In the manufacture of 31 million cubic feet of water gas daily, the Elizabethtown Consolidated Gas Company handles carloads of coal and coke to provide red hot fuel and an ample supply of steam to the gas generators. To unload and store this fuel, and to dispose of boiler-plant ashes, three Link-Belt automatic skip hoists and one Link-Belt semi-automatic skip hoist have been found highly satisfactory. Skip hoists are well adapted in general to high lifts, and for handling large or coarsely broken, abrasive or corrosive material. Link-Belt automatic skip hoists are started by a push button, and bucket continues to load, elevate, and discharge until the track hopper is empty or the stop button is pushed. Automatic action, low power consumption, low upkeep and long life combine to make Link-Belt skip hoists a preferred means of handling coal, coke and ashes at such installations. Link-Belt engineers can give valuable aid in selecting the best type and size of materials handling equipment to meet your specific needs.

Above: Skip hoist on left is balanced bucket type, 147 ft. lift, with two 80 cu. ft. buckets. Link-Belt vibrating screens over two bins separate fines, or coke breeze, which is chuted to breeze bin, foreground, then loaded into cars and taken to boiler house. Single bucket, counterweighted type, on right has 155 ft. travel, 120 cu. ft. bucket. Fuel handling skip hoist at boiler house is single bucket, automatic type, with 128 ft. travel and 65 cu. ft. bucket.



Left: Link-Belt semi-automatic skip hoist, 45 ft. travel with 30 cu. ft. bucket for placing boiler house ashes in bin for loading into trucks.

Right: 80 cu. ft. skip bucket at top of lift, immediately after discharge.

LINK-BELT COMPANY

Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Houston 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8, Johannesburg. Offices in Principal Cities.

11,839

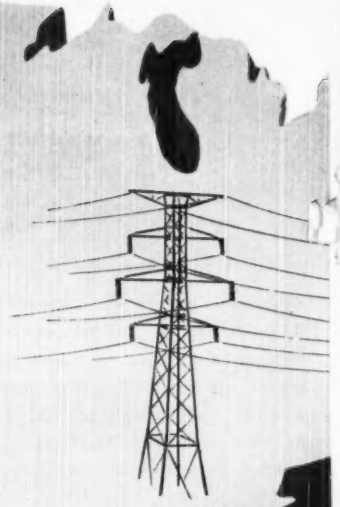
LINK-BELT

COAL AND ASHES HANDLING MACHINERY

1000 F Reheat for Oswego

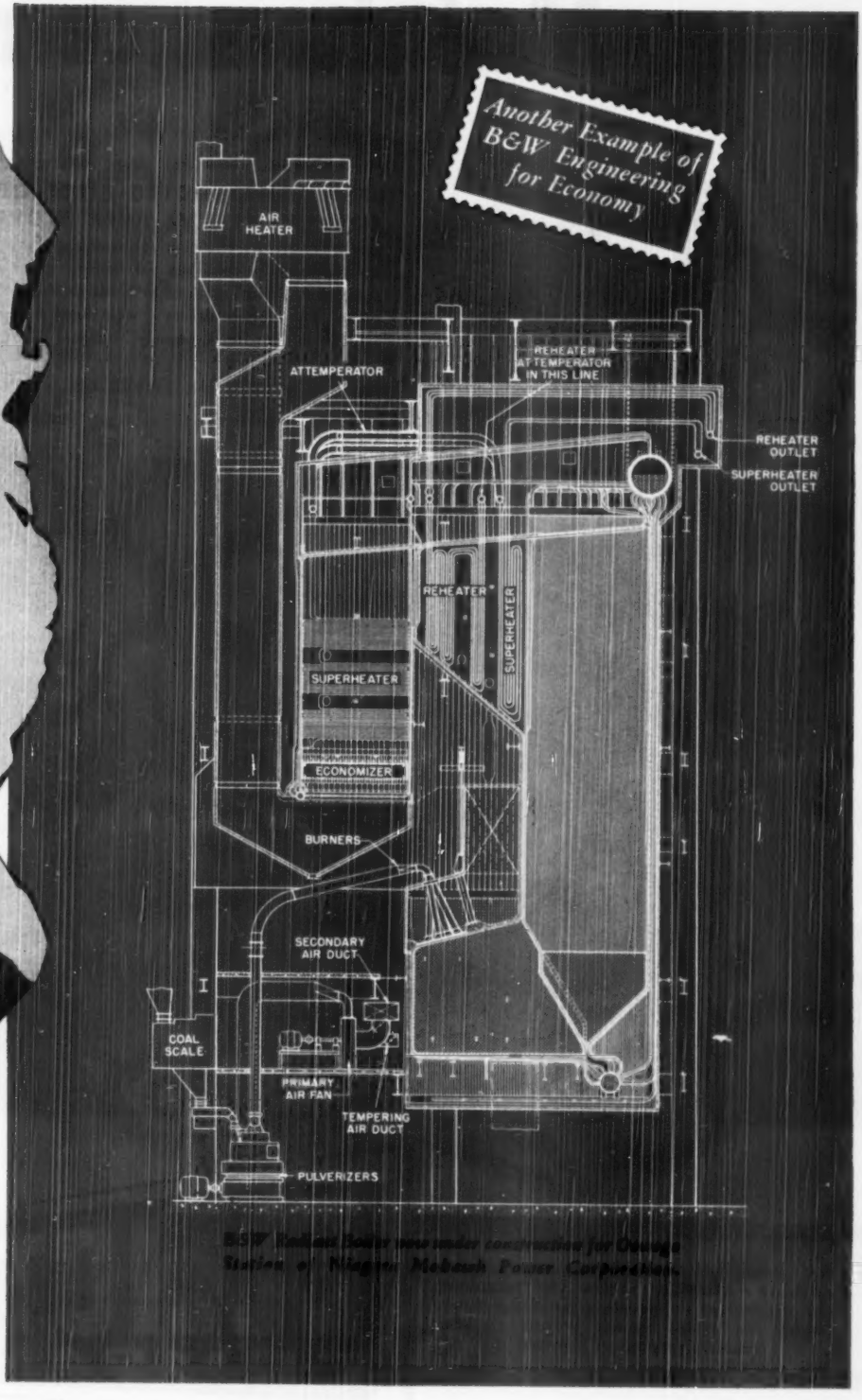
A new B&W Radiant Boiler now on order for Oswego Station of Niagara Mohawk Power Corporation, like the three B&W units already in service there, is designed for one-boiler-per-turbine operation. The new pulverized coal-fired installation will also incorporate a resuperheat cycle. Design capacity is 655,700 lb. per hr. at 1675 psi and 1000 F, with reheat to 1000 F.

This latest installation will bring the total steam capacity of B&W "solo" performers at Oswego to 3,330,700 lb. per hour.



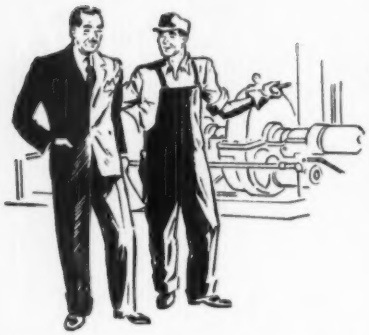
BABCOCK & WILCOX

G-451

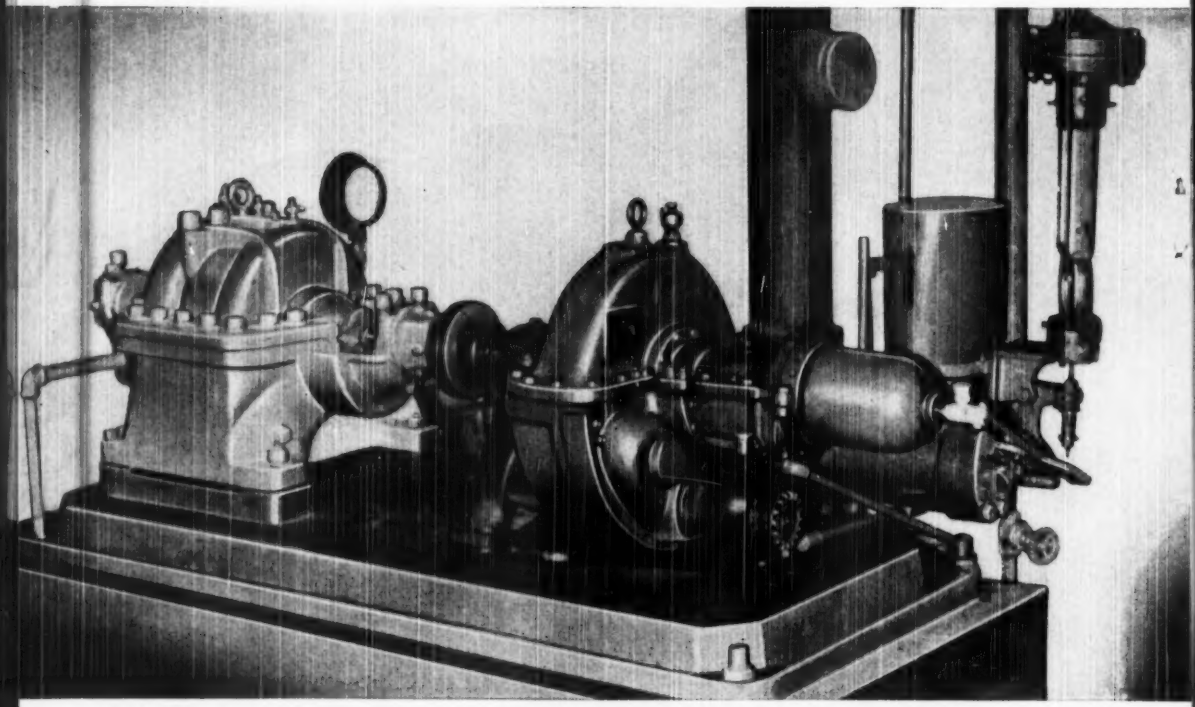


B&W Radiant Boiler now under construction for Owego Station of Niagara Mohawk Power Corporation

Maintenance men



"BEST CONSTRUCTED PIECE OF EQUIPMENT I'VE EVER WORKED ON" said maintenance engineer Johnson about the Elliott turbine in the photo below. "It's particularly quiet and smooth in operation. There's a lot of machine here! We're very proud of it." The turbine drives a boiler-feed pump in the Standard-Coosa-Thatcher Company National Plant, Rossville, Ga.



STEAM TURBINES • GAS TURBINES • GENERATORS • MOTORS
CONDENSERS • FEEDWATER HEATERS AND DEAERATORS
STEAM JET EJECTORS • CENTRIFUGAL BLOWERS • TURBO-CHARGERS FOR DIESEL ENGINES • TUBE CLEANERS
STRAINERS • EXPANDERS • FILTERS

ELLIOTT COMPANY

know the answer

A machine that gets the whole-hearted approval of the maintenance staff, has passed the acid test of mechanical equipment. This is so generally the case with Elliott YR turbines that the matter is no longer in question. Reports like that on the opposite page come in constantly.

Management too, favors this turbine, not only for its low maintenance, but also because of its adaptable qualities. Without sacrifice of standardization, its many permissible modifications enable the YR turbine to click with practically any specific requirement.

- Six elective governors
- Manual or remote control speed changers
- Choice of protective tripping arrangements
- True centerline supports
- Easily removable packing cases
- Sealed bearings
- Sealed governor
- Balanced double-seated valves
- Economical liner type bearings

Elliott YR turbines are suitable for operation on exhaust pressures up to and including 250 psi. Write for the fully informative bulletin.

H-725

STEAM TURBINE DEPT., JEANNETTE, PA.

Plants at: JEANNETTE, PA. • RIDGWAY, PA. • AMPERE, N. J. • SPRINGFIELD, O. • NEWARK, N. J.

DISTRICT OFFICES IN PRINCIPAL CITIES

The ADVANTAGES of *Automatic Operation* ARE NOW AVAILABLE TO Manually Operated DIAMOND G9B SOOT BLOWERS

By means of a simple field change and the addition of power air, any manually operated Diamond Model G9B Soot Blower can be converted to automatic (air) operation. The sheave wheel, chain guide and chain of the manually operated blower are removed and replaced by the air control assembly and gear guard as shown at the right.

The converted G9B blower is set in operation simply by opening a valve at the blower; the unit then automatically goes through the preselected blowing cycle and stops. The valve is then closed manually. By addition of a control panel, full automatic SEQUENTIAL blowing is available.

The Diamond Model G9B is the most widely used of all soot blowers. This permanently installed (multi-nozzle element) steam blower of proven dependability has numerous outstanding features. Included are cam and trigger valve operation, flexible element connection and adjustable pressure control. To these can now be added the many advantages of automatic or automatic sequential operation at moderate cost. Conversion takes little time in the actual changeover, and the blowers are not removed from the boiler wall. Get in touch with the nearest Diamond office for further information or write directly to us at Lancaster, Ohio.

Diamond Short Retracting and Long Retracting Soot Blowers that are Manually Operated also can be Converted to Automatic Operation in the Field.

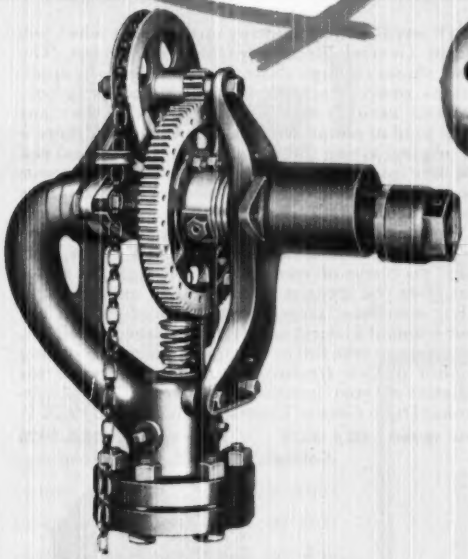
• *WRITE FOR INFORMATION*

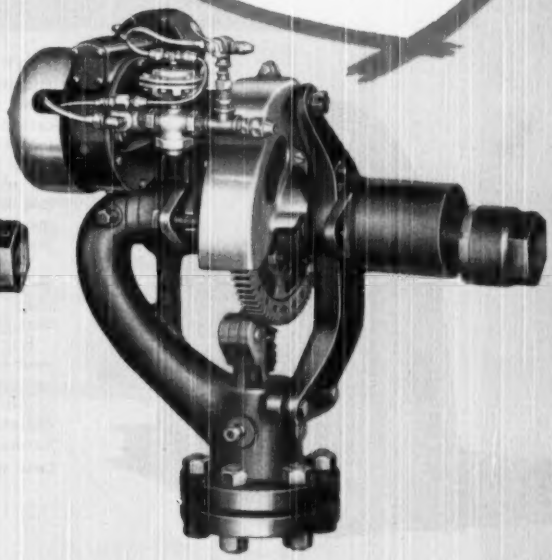
DIAMOND POWER

CONVERSION IS EASY IN THE FIELD

Before CONVERSION

After CONVERSION





Manual Operation

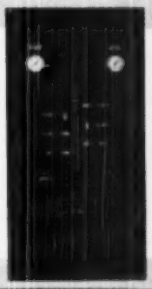
Operator opens valve in steam line . . . then pulls the chain that opens and closes the valve in head and simultaneously rotates the element. His time and attention are required throughout operation.

Automatic Operation

The operator simply opens a valve . . . the automatic air control then takes over and assures correct cleaning every time.

Automatic SEQUENTIAL Operation Requires only the Addition of a Control Panel

Any number of Model G98 Soot Blowers converted to automatic operation can be used in an automatic sequential system by the addition of a Diamond Control Panel. Other types of blowers can also be included in the system. The operator simply moves the start and stop valve carrier to the down position and then goes about his other duties. Traveling upward it operates each selected unit or group in turn . . . shuts off when all cleaning cycles are completed. It shows at a glance the units in operation and those that have operated. No electrical connections whatever.



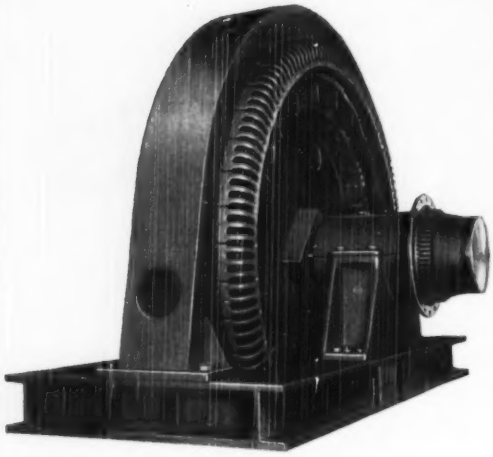
SPECIALTY CORP., Lancaster, Ohio

Diamond Specialty Limited • Windsor, Ontario

4177

Save on original costs

use G-E synchronous

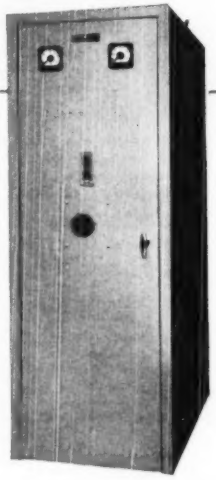


You'll save money in many applications when you specify General Electric synchronous motors. The chart shows (ratings above the black line) the applications where synchronous motors (including control and exciter) have a lower first cost than any other kind of motor. And even in cases where there is no original saving (between red and black lines) you can save on over-all cost by specifying synchronous motors to increase operating efficiency and improve power factor.

When you specify G-E synchronous motors, you get application engineering by experts in the electrical problems of *your* industry. You get the motor that gives you greatest return on your investment.

For your next large, constant-speed motor, ask your General Electric sales representative to tell you how you can take full advantage of the money-saving features of G-E synchronous motors. Or write for bulletins on your letterhead to *Section 770-17, Apparatus Dept., General Electric Co., Schenectady 5, N.Y.*

Low speed . . GEA-5332 **High speed . . GEA-5426**
Control . . GEC-505



PROTECT YOUR SAVINGS WITH G-E SYNCHRONOUS MOTOR CONTROL

New rotor field circuit provides accurate field application—motor is protected against starting shock.

New rotor field circuit keeps constant check on motor performance and, on pull-out, field is removed before first slip cycle is completed—to protect against electrical and mechanical damage.

In addition to the protection offered by the new rotor field circuit, the **new, smaller air-break Limitamp controller** provides fast-acting EJ-2 Fuses that limit short circuits to less than one-half cycle for motors up to 5000 volts.

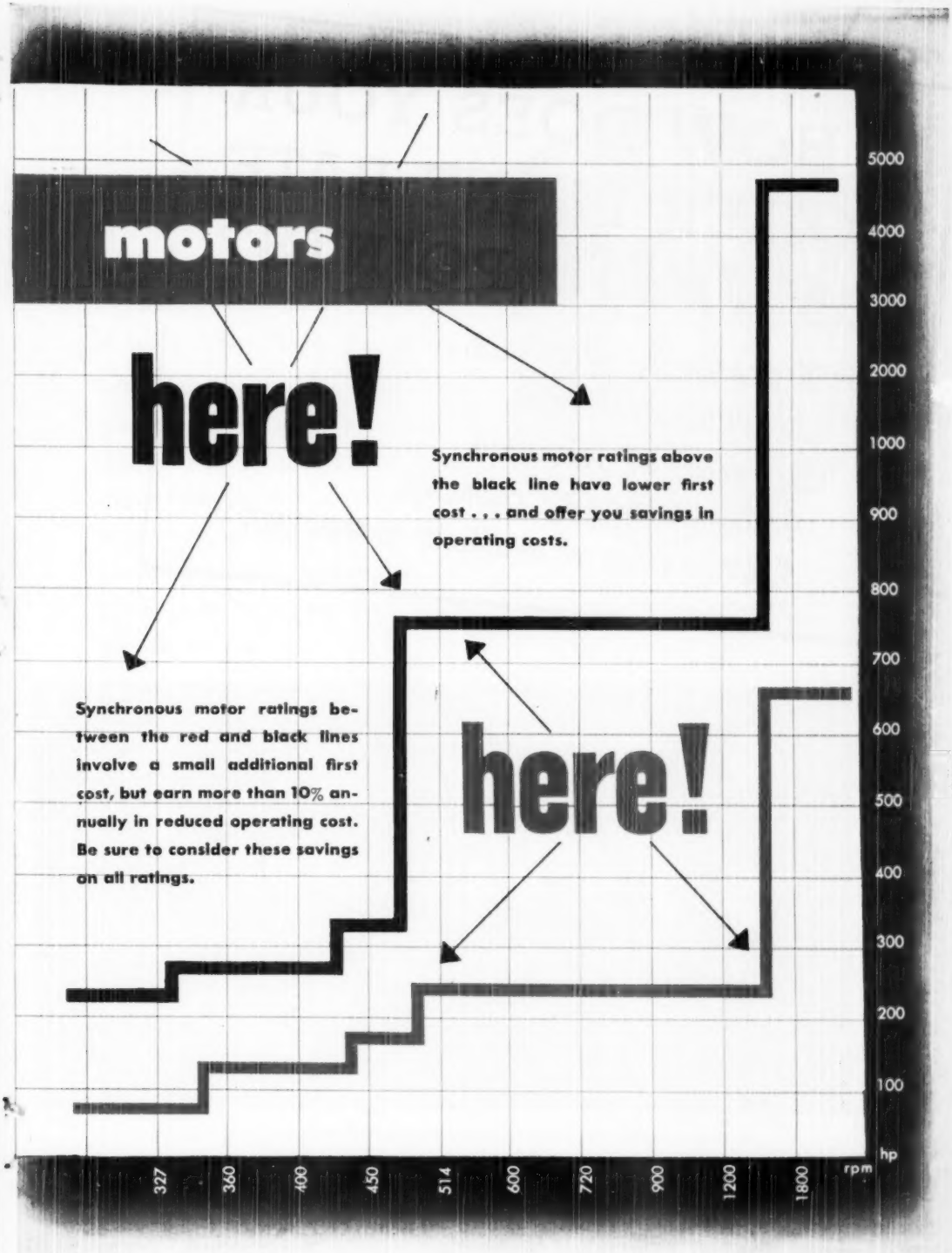
Low-voltage motors (up to 600 volts) are protected by compact, easily inspected air-circuit breakers.

To make it easier to install, to adjust, to operate, and to service, G-E synchronous control is factory-mounted in a steel enclosure with anti-glare meters and all the built-in accessories required for your application.

Come to General Electric for the engineering and manufacturing that will assure you of adequate protection of your motor and plant investment. Write for more information on this precise motor control.

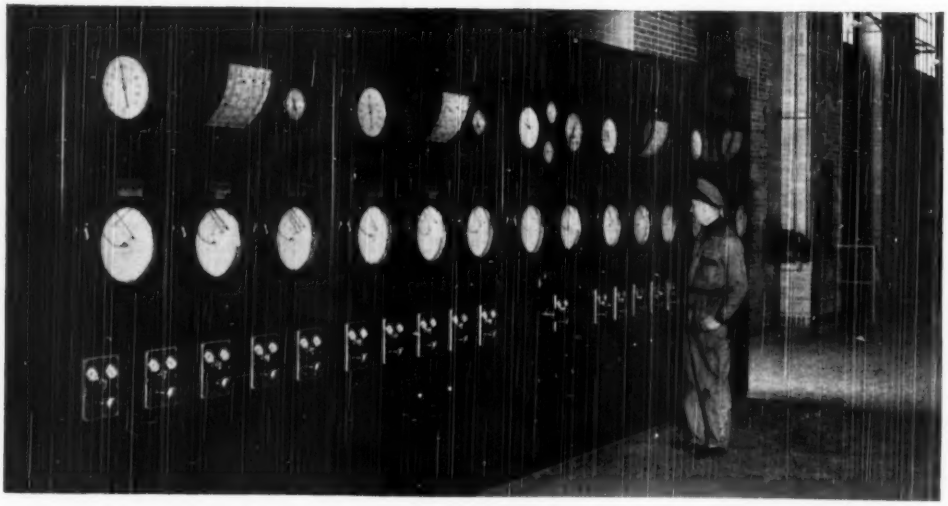
GENERAL ELECTRIC

770-17


motors
here!
Synchronous motor ratings above the black line have lower first cost . . . and offer you savings in operating costs.
Synchronous motor ratings between the red and black lines involve a small additional first cost, but earn more than 10% annually in reduced operating cost. Be sure to consider these savings on all ratings.
here!
5000
4000
3000
2000
1000
900
800
700
600
500
400
300
200
100
hp
327
360
400
450
514
600
720
900
1200
1800
rpm

HOW DOES YOUR BOILER PLANT RATE ON *THESE* POINTS?

1. *Continuity of service.*
2. *Evaporation ratio.*
3. *Safety of operation.*
4. *Peak steaming capacity.*
5. *Utilization of available manpower.*



This Bailey Boiler Control Panel continuously maintains Optimum Performance in a central heating plant.

BAILEY METER CONTROL . . .

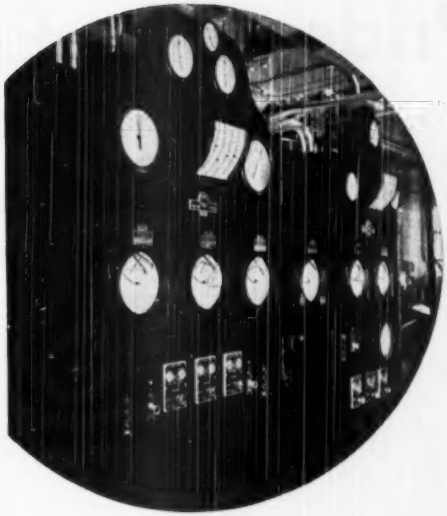
BOILER METERS • MULTI-POINTER GAGES • FLUID METERS • RECORDERS • SUPERHEAT

★ Optimum performance may be secured on all these counts by applying engineered instrumentation in the form of Bailey Boiler Meters and Control.

Bailey Boiler Meters and Control are specified and applied to the individual requirements of each plant. Bailey engineering service starts with the selection of equipment and continues through the design, construction, calibration, installation, and final adjustment on the job.

Engineering work in the user's plant is done by Bailey Field Engineers, who have been thoroughly trained in combustion and automatic control practice. These engineers are stationed in over thirty industrial areas throughout the United States and Canada for the purpose of rendering prompt "on the spot" engineering service without undue traveling expense.

The Bailey Engineer in your community has a background of combustion engineering "know-how" which has been accumulated through years of service. He has at his command the results of thousands of tests on boiler installations covering a wide range of fuels, furnaces, and fuel burning equipment. He has more to offer than meters and controllers. He is primarily interested in helping you to secure optimum operating conditions in your plant.



Installation of Bailey Boiler Meters and Boiler Control in an Eastern paper mill. This equipment automatically functions to maintain daily boiler performance at the same high standards obtained during boiler tests.

G-24

BAILEY METER COMPANY
1036 IVANHOE ROAD, CLEVELAND 10, OHIO
Bailey Meter Company Limited, Montreal, Canada

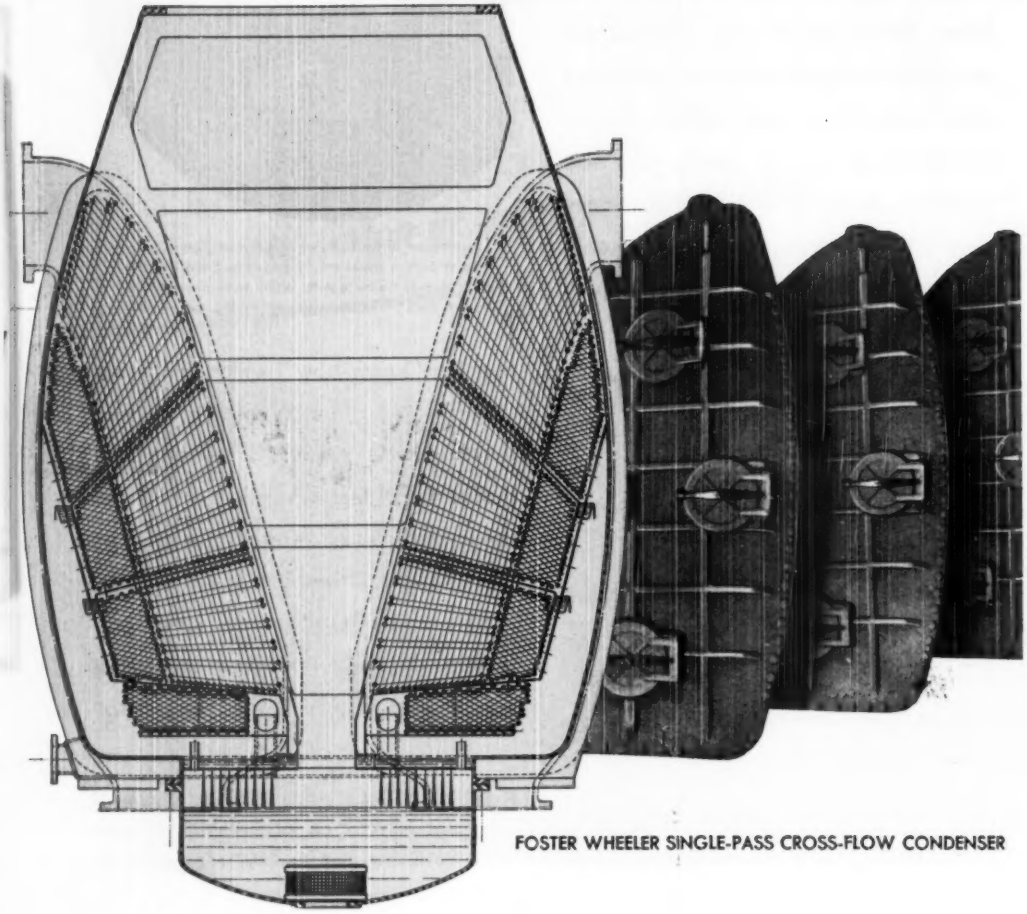
The Complete Combustion Control System

CONTROL • DESUPERHEAT CONTROL • COMBUSTION CONTROL • FEED WATER CONTROL

Pride of the Public Service

uses

Foster Wheeler

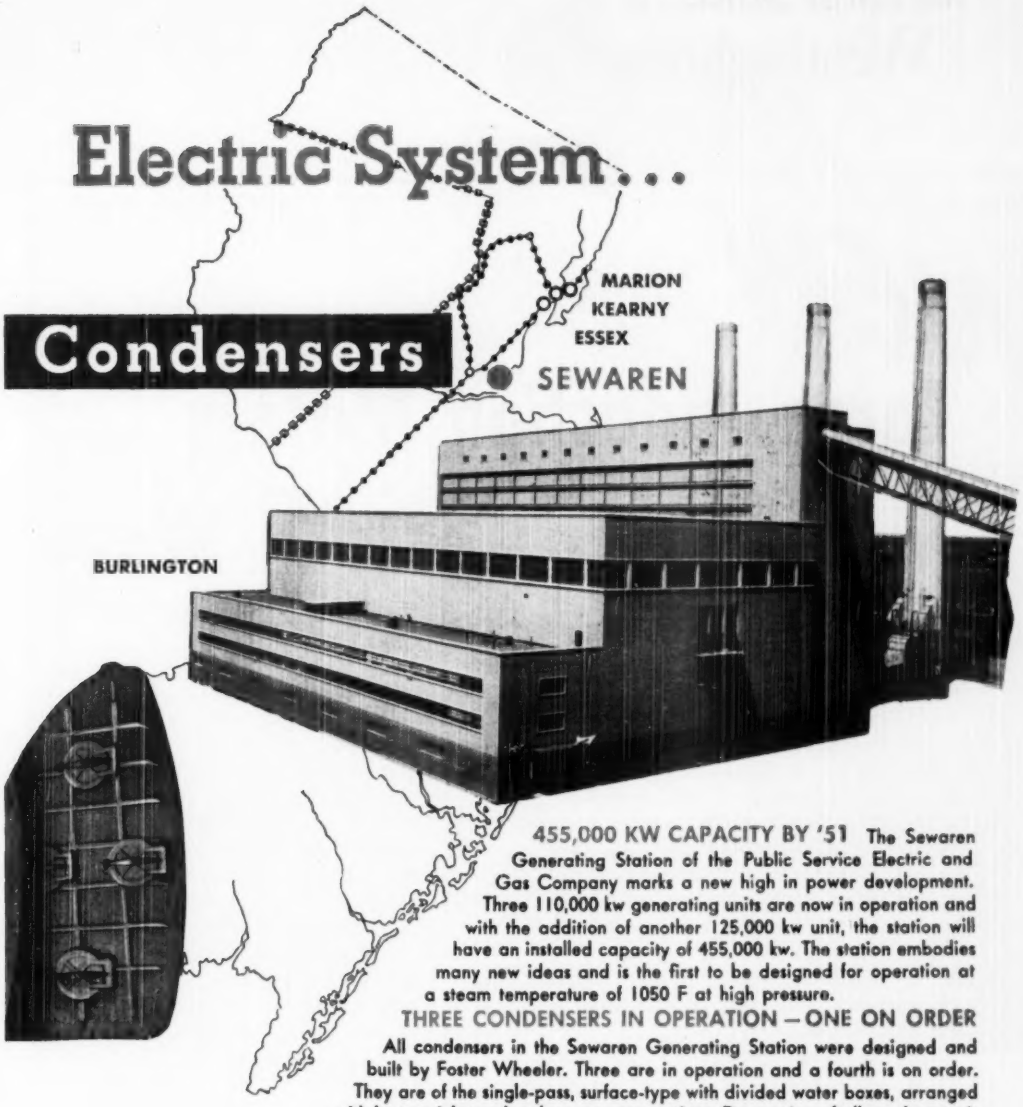


FOSTER WHEELER SINGLE-PASS CROSS-FLOW CONDENSER

FOSTER WHEELER CORPORATION • 165 BROADWAY,

Electric System...

Condensers



455,000 KW CAPACITY BY '51 The Sewaren Generating Station of the Public Service Electric and Gas Company marks a new high in power development. Three 110,000 kw generating units are now in operation and with the addition of another 125,000 kw unit, the station will have an installed capacity of 455,000 kw. The station embodies many new ideas and is the first to be designed for operation at a steam temperature of 1050 F at high pressure.

THREE CONDENSERS IN OPERATION — ONE ON ORDER

All condensers in the Sewaren Generating Station were designed and built by Foster Wheeler. Three are in operation and a fourth is on order. They are of the single-pass, surface-type with divided water boxes, arranged with bottom inlet and outlet water connections. Deaeration of all condensate is accomplished in the deaerating hotwells. With the addition of the fourth unit at Sewaren, there will be a total of nine large Foster Wheeler condensers in operation in the electric system of the Public Service Electric and Gas Company.

Other Foster Wheeler equipment presently in operation at Sewaren includes nine ball mill pulverizers and twelve high pressure and three low pressure feedwater heaters and two single effect evaporators, the latter equipment being part of the eight-stage feedwater heating cycle which is in use in this country only in Public Service stations.

NEW YORK 6, N. Y.

FOSTER WHEELER

YOU CAN BE SURE.. IF IT'S
Westinghouse

NEW
Large Induction Motors Cut Maintenance Costs 2 Ways

Ease of inspection . . . low-cost maintenance stand out in industry's new large motor—the Westinghouse ***Type CSF.***

Heading the list of cost-cutting features are sectional construction of end covers and air shields. Gone is the need for overhead cranes and costly, time-consuming operations. There's no top half of the bracket to remove . . . only the top half of the bearing housing.

Sectional covers can be removed from both ends of the motor in a few minutes for complete inspection, cleaning and other servicing requirements. The rotor and brackets need not be disturbed.

Split-sleeve bearings and oil rings make inspection or replacement easy. Simply remove the bearing housing cap. Bearings can be removed and replaced, by hand, without disturbing the bracket mounting.

Permanently aligned bearings assure proper air gap. The bottom half of the bearing housing is integral with the bracket, which is accurately machined and held in perfect alignment by a rabbet fit on the stator.

Added to these outstanding advantages are many other features that tell you these motors are built to do your job best . . . at lower cost. Get the facts from your Westinghouse representative, or write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pa.

J-21551

Westinghouse
LARGE INDUCTION MOTORS

Westinghouse **Type CSF** *Motors are available, squirrel-cage or* **Type CWF** *wound rotor, in four types: drip-proof, outdoor, splashproof and totally-enclosed, fan-cooled—in frame sizes 30 and larger, 4 or more poles.*

TWO

A FEW REPRESENTATIVE USERS OF YARWAY BLOW-OFF VALVES

Pennsylvania Power & Light Co.
Cleveland Elec. Illuminating Co.
Connecticut Light & Power Co.
Duke Power Co.
Georgia Power Co.
Lynn Gas & Electric Co.
Pacific Gas & Electric Co.
Philadelphia Electric Co.

American Viscose Co.
Armour & Company
Bethlehem Steel Co.
Celanese Corporation
Eastman Kodak Co.
Fibreboard Products Co.
Gulf States Paper Co.
Lever Bros., Co.
Ohio Oil Co.
Phelps DeOge Corp.
R. J. Reynolds Tobacco Co.
Solvay Process Co.

Yarway Type "B" Seatless Tandem Blow-Off Valve. For pressures to 400 psi. Ask for Bulletin B-424.

YARWAY

REASONS

FOR USING

GOOD BLOW-OFF VALVES

1. To be sure of *tight* blow-down lines.

2. To withstand the severe punishment of regular or emergency blowing-down under pressure and periodic acid wash.

Yarway Blow-Off Valves are *good* blow-off valves—designed and built to safeguard beyond any doubt your sizeable boiler investment.

To give you drop-tight protection required for efficient boiler operation, Yarway offers Seatless Valves that have no seat to score, wear, clog and leak . . . or heavy-duty Yarway Stellite Hard-Seat Valves.

Either valve, or any tandem combination, also provides ruggedness and safety beyond any emergency requirements.

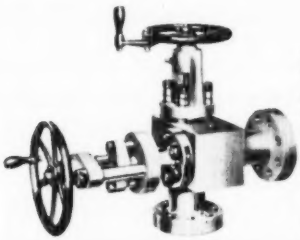
It is no coincidence that more than 15,000 boiler plants throughout the world use Yarway Blow-Off Valves . . . and among high pressure plants, 4 out of every 5 are Yarway-equipped.

For the full story on blow-off valves for *your* boilers, write today for the Yarway Bulletin. *Please mention pressure range.*

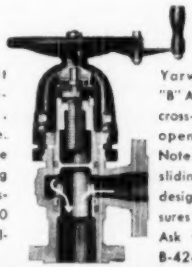
YARNALL-WARING COMPANY

100 Mermaid Avenue, Philadelphia 18, Pa.

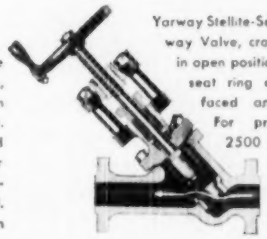
Branch Offices in Principal Cities



Yarway Unit Tandem Blow-Off Valve. Flanged type. Also available with welding ends. For pressures up to 2500 psi. Ask for Bulletin B-432.



Yarway Type "B" Angle Valve, cross-sectioned in open position. Note balanced sliding plunger design. For pressures to 400 psi. Ask for Bulletin B-424.



Yarway Stellite-Seat Straightway Valve, cross-sectioned in open position. Disc and seat ring are stellite-faced and ground. For pressures to 2500 psi. Ask for Bulletin B-432.

For any fuel or combination of fuels

The HAGAN Differential Master Method of Automatic Combustion Control

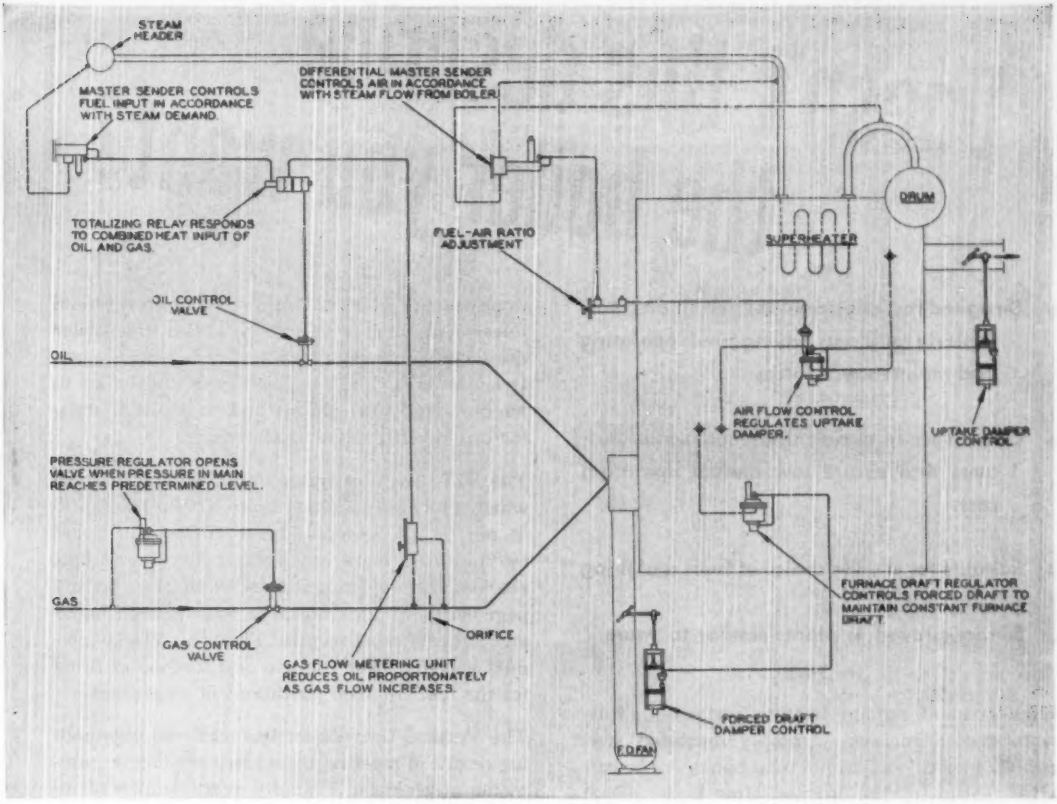
In many installations, fuel economy demands that boilers be able to use two, three or even more fuels, either singly or in varying combinations. Heat input may not remain at a constant rate, because of variations either in calorific value of the fuel, or in operation of feeding mechanisms.

Under such conditions, however, the Hagan Differential Master method of combustion control automatically maintains proper combustion conditions in a simple and direct way, using the boiler unit itself as a calorimeter of heat input to establish the correct air requirements.

A Master Sender, sensitive to steam header pressure, regulates the rate of fuel feed so that Btu input is in accordance with demand.

A Differential Master Sender, measuring steam flow, regulates air flow.

HAGAN
HALL
BUROMIN
CALGON


STEAM HEADER
MASTER SENDER CONTROLS FUEL INPUT IN ACCORDANCE WITH STEAM DEMAND.
DIFFERENTIAL MASTER SENDER CONTROLS AIR IN ACCORDANCE WITH STEAM FLOW FROM BOILER.
TOTALIZING RELAY RESPONDS TO COMBINED HEAT INPUT OF OIL AND GAS.
FUEL-AIR RATIO ADJUSTMENT
DRUM
SUPERHEATER
OIL CONTROL VALVE
OIL
AIR FLOW CONTROL REGULATES UPTAKE DAMPER.
UPTAKE DAMPER CONTROL
PRESSURE REGULATOR OPENS VALVE WHEN PRESSURE IN MAIN REACHES PREDETERMINED LEVEL.
FURNACE DRAFT REGULATOR CONTROLS FORCED DRAFT TO MAINTAIN CONSTANT FURNACE DRAFT
GAS
GAS CONTROL VALVE
ORIFICE
GAS FLOW METERING UNIT REDUCES OIL PROPORTIONATELY AS GAS FLOW INCREASES.
FORCED DRAFT DAMPER CONTROL
F.D.FAN

These units are not interconnected. Each has its own function, and performs that function **directly.** The rate of fuel feed is changed instantly to compensate for any change in steam demand or variation in calorific value of fuel or in feeder characteristic. Air, however, is changed only when there is an actual change in steam flow.

Control is direct and accurate. There is no necessity for approximate adjustment, to be corrected by a lagging corrector system. Fuel savings are substantial.

Our engineers will be glad to discuss the advantages which the Hagan Differential Master System offers for your plant. Hagan Corporation, Hagan Building, Pittsburgh 30, Pa.

HAGAN CORPORATION

BOILER COMBUSTION CONTROL SYSTEMS
RING BALANCE FLOW AND PRESSURE INSTRUMENTS
METALLURGICAL FURNACE CONTROL SYSTEMS
THRUSTORQ FORCE MEASURING DEVICES

Doesn't this describe the boiler you want?

- **Designed for industrial load conditions, particularly for plants having small operating and maintenance forces**
- **Offers special design and construction features that assure low annual operating costs**
- **Suitable for a wide choice of fuels and firing**
- **Service-proved in plants similar to yours**

High ratio of radiant heating surfaces . . . fully water-cooled furnace . . . amply insulated steel casing . . . easily accessible tube banks . . . feature after feature of the Vertical-Unit Boiler, Type VU-10, assure top performance with low operating and maintenance costs throughout the lifetime of the equipment. Moreover, because of its symmetrical design every foot of boiler width handles the same amount of water, is swept by the same quantity of gas, and thus absorbs the same amount of heat. This assures uniform steam release, uniform water level across the boiler drum and uniform expansion of pressure parts. It accounts, too, for the ability of the boiler to handle rapid load swings and to produce satisfactory steam quality at all ratings.

The VU-10 is a compact unit, available in sizes which provide capacities from 10,000 to 60,000 lb per hr. Its adaptability to various fuels and methods of firing is emphasized by the fact that the five types of firing illustrated on the opposite page are all applicable to the same general boiler and furnace cross-section. Thus the VU-10 permits you to choose the one *best* method of firing for the fuel and load conditions of your plant.

The Vertical-Unit Boiler has made an outstanding record in meeting the widely varying requirements of plants in virtually every branch of industry. A partial list of the industries that have selected the VU-10 is shown below. The chances are that some plant – or plants – with operating conditions similar to yours are now profiting from VU-10 performance. Let us suggest one in your locality where you can make your own check.

B-399

PARTIAL LIST OF INDUSTRIES THAT HAVE SELECTED THE VU-10 BOILER

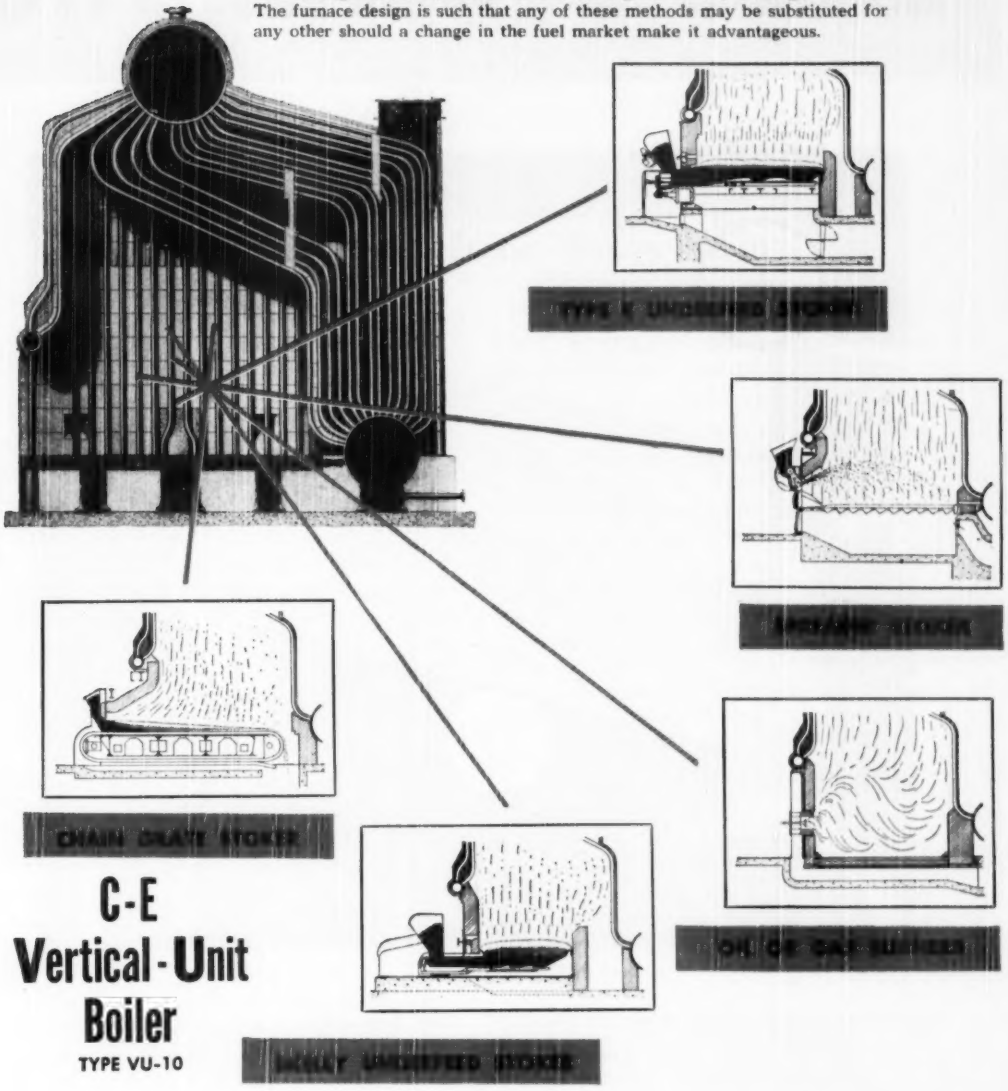
AUTOMOBILE	COLD STORAGE	HOSIERY	LINOLEUM	PAINT	STEEL
BAKERIES	DAIRIES	HOSPITALS	MACHINERY	PAPER	SUGAR
BREWERIES	DISTILLERIES	INSTITUTIONS	METALS	RAILROADS	TEXTILE
CEMENT	FOOD	LAUNDRIES	OIL	RUBBER	TOBACCO
CHEMICAL	GLASS	LEATHER	PACKING	SCHOOLS	UTILITY

COMBUSTION ENGINEERING

ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS AND AIR HEATERS

For every fuel market and every type of load there is *one best* method of firing. The selection of that *one best* method for the fuel and load conditions of a particular plant calls for judgment based on broad experience and free from any incentive to favor one type of equipment over another.

The Type VU-10 Boiler is designed for five methods of firing—spreader stoker, single-retort underfeed stoker, chain grate stoker, oil or gas burners. The furnace design is such that any of these methods may be substituted for any other should a change in the fuel market make it advantageous.



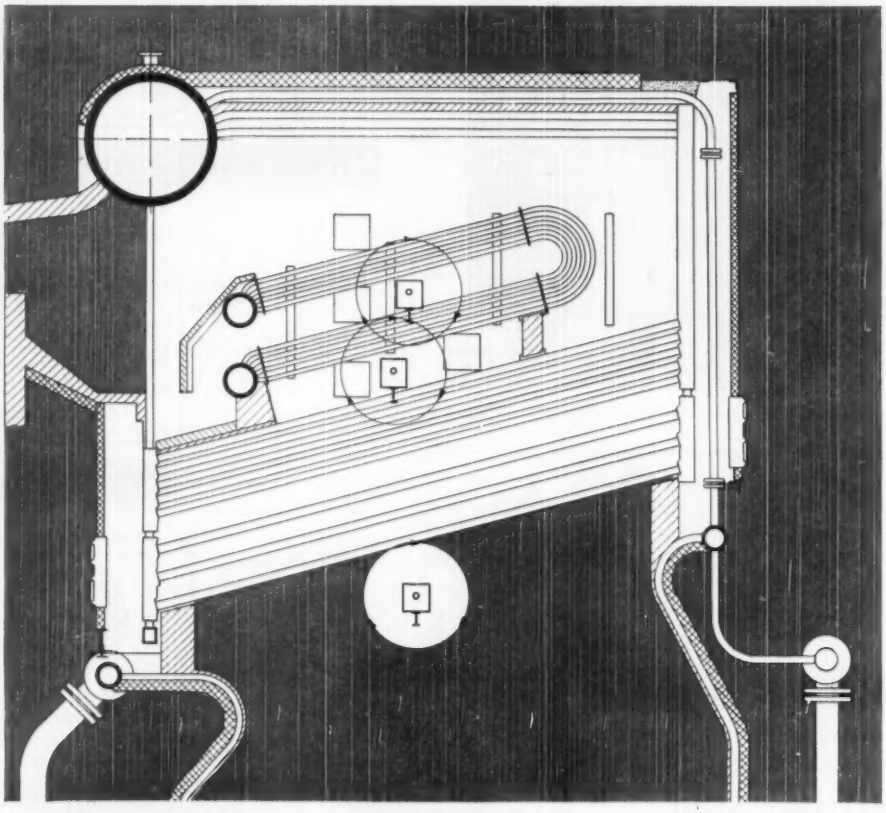
C-E Vertical-Unit Boiler

TYPE VU-10

— SUPERHEATER, INC.

200 MADISON AVENUE, NEW YORK 16, N. Y.

Here's what the



Six Vulcan T-2 Long Retractable Soot Blowers are installed on each of the six B & W boilers, rated at 400,000 pounds per hour at 1400 psi.

These blowers are built or travels up to 25 feet and are push-button controlled at the unit, or from a central control panel. Described in Bulletin 474.

VULCAN Automatic

operators say--

"The new blowers complete in minutes what formerly took man hours"

". . . nothing new under the sun? Look at those soot blowers . . . They have made boiler cleaning a cinch. Remember how the boiler cleaners once had to slave to free the tubes of slag? It's a pushover now. Just push a button and let 'er go. They do a better job, a cleaner job and a more thorough job.

"The controlling machinery, which rotates the lance, pushes it into the boiler, pulls it out . . . the automatic valve for turning steam on and off at the proper time all are located outside the boiler. The simple motion of pressing a button starts the operation.

"On the lower tubes, where the blowers use 350 pounds steam pressure, the retractables will rip off adhering slag which the old fashioned blowers wouldn't touch. This slag had to be knocked off by hand, piece by piece, tube by tube, with a 24-foot water-cooled hand lance. The new blowers complete in minutes what formerly took man hours.

"In the superheaters, these soot blowers keep the tubes cleaner than combined hand lancing and the old-fashioned soot blowers could. The push button has eliminated hand lancing and the hard, hot labor required to turn the old soot blowers.

"Two previous installations (of old-fashioned soot blowers) on the reheater of 2-1 boiler were complete failures. The reheater slowly plugged up with caked dust and had to be rodded out and washed during boiler outages. Now it can be kept clean indefinitely, eliminating boiler outages and the hard work of rodding and washing. The old soot blowers required hand opening of 26 separate valves. The retractables are operated by pushing 7 buttons. 'Yes, things are certainly looking rosy for the boiler cleaners.' "

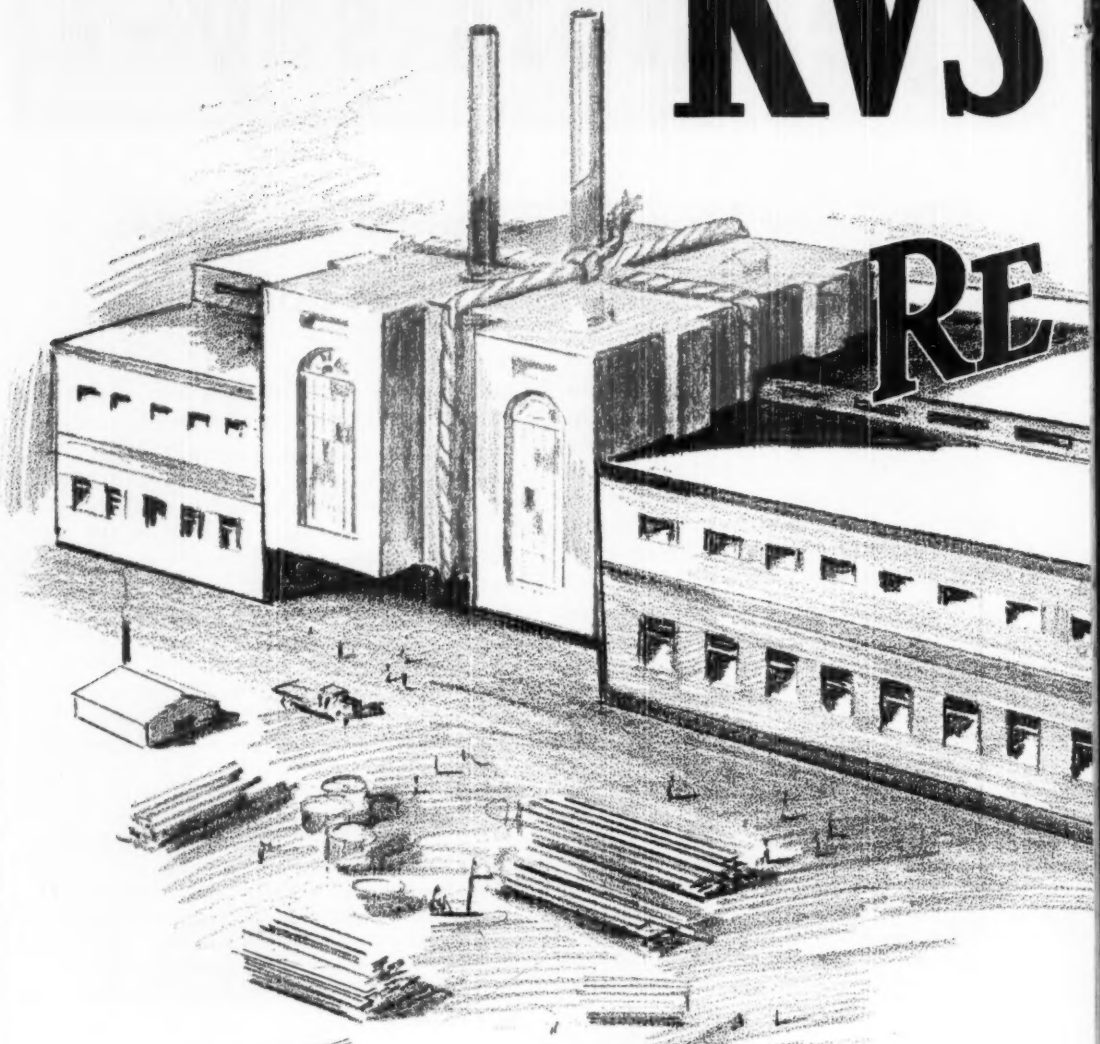
—V—

This story was taken from the magazine a large mid-western utility publishes for its employees. It tells—far better than words of ours—what direct benefits users are now getting from Vulcan Automatic Soot Blowers.

VULCAN SOOT BLOWER DIVISION
Continental Foundry & Machine Company
DUBOIS, PENNSYLVANIA

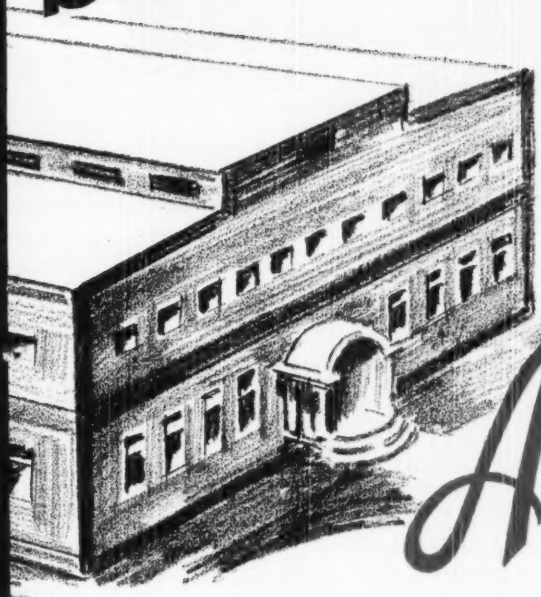
KVS

RE



Ask for a copy of 97-page Engineering Bulletin No. 44-B containing valuable information on preparation of pulverized fuel and steam generating plants.

SPONSIBILITY... POWER



for use Anywhere

Low Cost Power.....from screenings..tailings..washings

KVS will build the complete plant . . . from bunker to bus bar . . to produce low cost power from any fuel that can be made to burn.

The contemplated plant can be of any capacity and pressure. It can be located in any part of the world where water and fue' are available. KVS will take over all responsibilities involved for building and equipping such a plant and guaranteeing its performance on completion.

This service contemplates KVS furnishing and installing equipment which it may or may not actually manufacfacture but which is backed by its builders' guarantees.

Our successful experience in furnishing complete power plants is a matter of record. You are cordially invited to investigate.

Kennedy-Van Saun

MANUFACTURING AND ENGINEERING CORPORATION

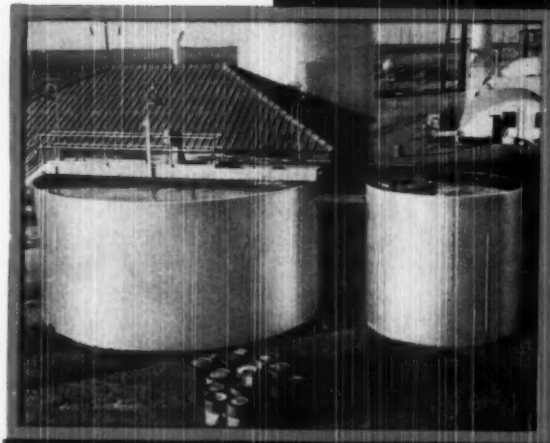
2 PARK AVENUE • NEW YORK 16, N. Y.

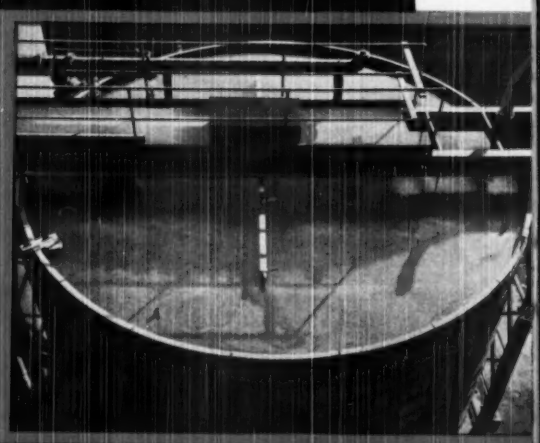
FACTORIES: DANVILLE, PA

CANADA • ENGLAND • FRANCE • AUSTRALIA

COCHRA

ECONOMICAL REMOVAL OF IMPURITIES FROM INDUSTRIAL WATER SUPPLIES – TURBIDITY, COLOR, HARDNESS – REMOVAL OF SUSPENDED SOLIDS FROM WASTE





COCHRANE'S recognized authority in the field of water conditioning is exemplified in the relatively new field of water clarification by flocculation, in the improved Cochrane Sludge Contact Reactor. This equipment is meeting with pronounced success wherever it has been installed.

The Cochrane Sludge Contact Reactor is distinguished by the fact that the sludge bed is always in suspension, so that the sludge is always present when chemicals and water react.

This is important, in that the precipitates or sludge must not be allowed to settle out on the floor of the tank if maximum clarification or softening is to be obtained. The water as it rises through the sludge bed is both treated and filtered.

Cochrane Sludge Contact Reactors are applicable to

1. Municipal and industrial plants for coagulation and/or softening, removal of turbidity, color, hardness, taste and odor
2. Boiler plants for silica removal
3. Fluoride removal, de-alkalization, iron and manganese removal
4. Paper, textile and other plants for process water—recovery of fibre stock and filler from white water

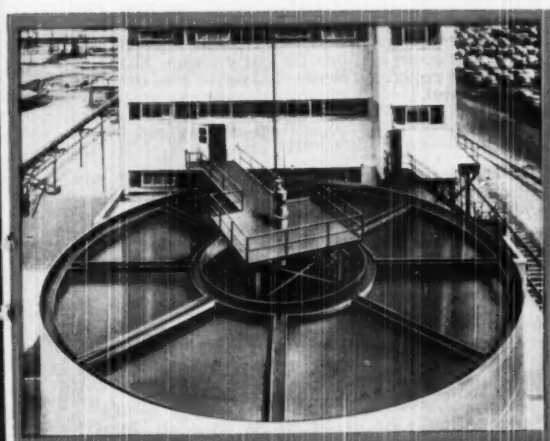
NEW PUBLICATION AVAILABLE

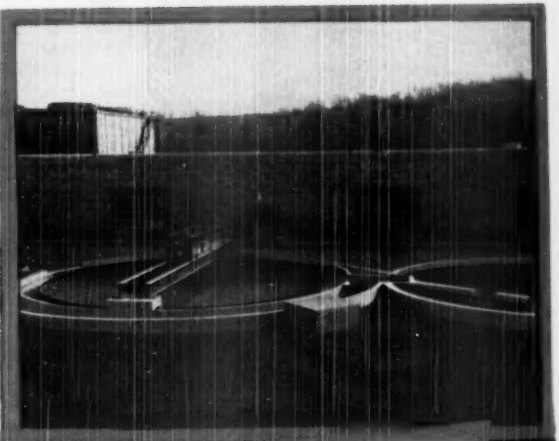
A new bulletin describing the Cochrane Sludge Contact Reactor, and illustrating different applications is just off the press. A copy will be sent on request.

COCHRANE CORPORATION, 17th St. & Allegheny Ave., PHILADELPHIA 32, PA.

In Canada: Canadian General Electric Co., Ltd., Toronto • In Mexico: Babcock & Wilcox de Mexico S. A., Mexico City

ANE ·Sludge· Contact REACTORS





COCHRANE OFFICES

ATLANTA, GA.
Boiler Equipment Service Co.
686 Greenwood Ave., N. E. (6)
Telephone: Hemlock 3636-3637

BALTIMORE, MD.
William A. Milby Co., Inc.
2701 Creamont Ave. (11)
Telephone: Hopkins 7774-7775

BOSTON, MASS.
Cochrane Steam Specialty Co.
80 Federal Street (10)
Telephone: HA 6-6447
(6-6416, 6-6448, 6-6449)

CHARLOTTE, N. C.
Neil H. Brown
1114 Liberty Life Bldg. (2)
Telephone: 3-7475

CHICAGO, ILL.
Cochrane Engineering Corp.
2017 Jackson-Franklin Bldg. (6)
309 West Jackson Blvd. (6)
Telephone: HA 7-0120, 0121, 0131

CINCINNATI, OHIO
Henry P. Thompson Company
1717 Section Road (16)
Telephone: Elmhurst 3140

CLEVELAND, OHIO
Dravo Corporation
4810 Prospect Avenue (3)
Telephone: Henderson 7500

DENVER, COLO.
Stearns-Roger Mfg. Company
1720 California Street (2)
Telephone: Acoma 2561

DETROIT, MICH.
The Frederick H. Mason Co.
1916 Ford Building (26)
Telephone: Woodward 2-3794

EL PASO, TEXAS
Stearns-Roger Mfg. Company
P. O. Box 38
Telephone: 36382

HARRISBURG, PA.
Irvin H. Geiger
P. O. Box 83
410 Telegraph Building
Telephone: 2-4994

HOUSTON, TEXAS
Alliger & Sears
5646 Navigation Blvd. (1)
Telephone: Wentworth 3-2823

INDIANAPOLIS, IND.
DeHaven Engineering Company
1444 Consolidated Bldg. (4)
115 N. Pennsylvania St. (4)
Telephone: Market 2563-2564

KANSAS CITY, MO.
Messplay Machinery Company
4610 Troost Avenue (4)
Telephone: Jefferson 1247

KNOXVILLE, TENN.
Leinart Engineering Company
412 East Fifth Ave. (5)
Telephone: 2-0153

LOS ANGELES, CALIF.
C. C. Moore & Co., Engineers
Richfield Bldg. (13)
Telephone: Trinity 1643

MINNEAPOLIS, MINN.
Bell & Eiss Inc.
2102 Foshay Tower (2)
Telephone: Atlantic 4596

NEW YORK, N. Y.
Turbine Equipment Company
75 West Street (6)
Telephone:
Bowling Green 9-1550-1-2-3-4

NEW ORLEANS, LA.
Allan J. Harris Company
400 Balter Building (12)
Telephone: Raymond 0228

PHILADELPHIA, PA.
Philadelphia Sales Division
Cochrane Corporation (32)
17th St. below Allegheny Avenue
Telephone: RA 5-2144

PHOENIX, ARIZ.
C. C. Moore & Co., Engineers
213-214 Luhrs Building
Telephone: 2-8391

PITTSBURGH, PA.
Dravo Corporation
Fifth & Liberty Avenues (22)
Telephone: Court 5400

PORTLAND, ORE.
C. C. Moore & Co., Engineers
1119 Failing Building (4)
Telephone: Atwater 9684

RICHMOND, VA.
Hawkins-Hamilton Co., Inc.
401-4 American Building (6)
Telephone: 3-0153, 3-0154

ROCHESTER, N. Y.
D. R. Mixsell
611 Hazelwood Terrace (9)
Telephone: Culver 4590

ST. LOUIS, MO.
Lane Machinery Company
419 Buder Building (1)
Telephone: Central 0371

SALT LAKE CITY, UTAH
Stearns-Roger Mfg. Company
405 Kearns Building
Telephone: 59071

SAN FRANCISCO, CALIF.
C. C. Moore & Co., Engineers
450 Mission Street (5)
Telephone: Garfield 3484

SEATTLE, WASH.
C. C. Moore & Co., Engineers
1916 Smith Tower (4)
Telephone: Main 1496

TUCSON, ARIZ.
B. F. Soffe (Western Sales Mgr.)
705 E. Broadway
Telephone: Tucson 3-4883

WASHINGTON, D. C.
Robert M. Austin
Barr Building (6)
Telephone: National 2343

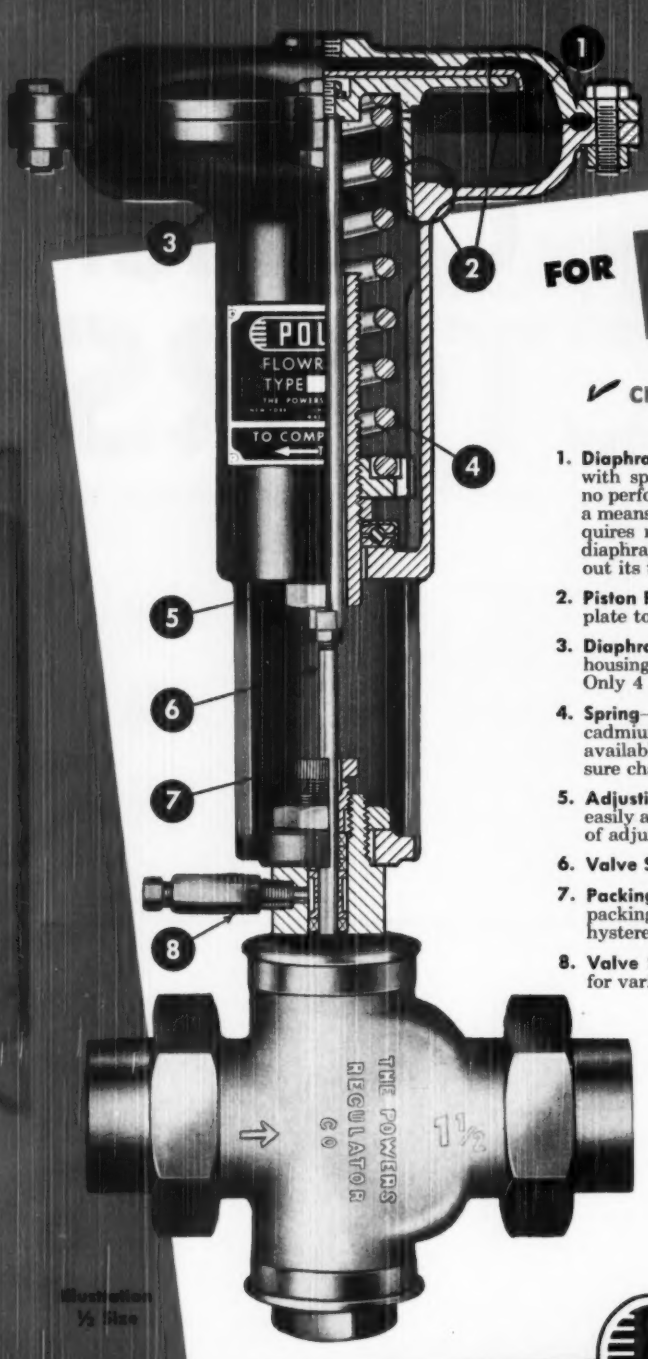


Illustration ½ Size

POWERS FLOWRITE VALVE

FOR BETTER CONTROL

✔ Check these Features of *NEW* POWERSTROKE TOP!

1. **Diaphragm**—Long life moulded Neoprene diaphragm with specially designed leak-proof sealing ring. Has no perforations or bolt holes. Diaphragm ring supplies a means for self-sealing under increasing pressure. Requires minimum of force for compression. Shape of diaphragm provides a constant effective area throughout its travel.
2. **Piston Plate**—Accurately guided self-aligning piston plate to eliminate side thrust.
3. **Diaphragm Housing**—Special high quality cast iron housing and top for ruggedness and corrosion resistance. Only 4 bolts are used to permit easy removal of top.
4. **Spring**—Enclosed special alloy steel calibrated spring, cadmium plated to prevent corrosion. Two spring rates available to give full valve travel in 5 or 10 lbs. pressure change in top.
5. **Adjusting Screw**—Ball bearing, non-rising type. Is easily accessible. Has 180° turning radius—wide range of adjustment.
6. **Valve Stem**—Polished stainless steel.
7. **Packing Gland**—Easily accessible, specially formed packing with metallic jacket for long life and low hysteresis.
8. **Valve Stem Lubricator**—Ball check type—lubricants for various conditions.

VALVES—Sizes: ½" thru 8". For line pressures up to 250 lbs. per square inch. Rugged construction to withstand piping strains.

VARIETY OF VALVE BODIES

Single seat or double seat, bronze and stainless steel trim. Double unions and flanged ends. Available normally open (direct acting) or normally closed (reverse acting) and 3-way mixing type valves.

POWERS

OVER 55 YEARS OF PNEUMATIC TEMPERATURE CONTROL—OFFICES IN OVER 50 CITIES

Complete Line of Controls for Heating and Air Conditioning Systems,

AND EXTRA YEARS OF DEPENDABLE SERVICE

POWERS

F and M AIR OPERATED CONTROL VALVES!

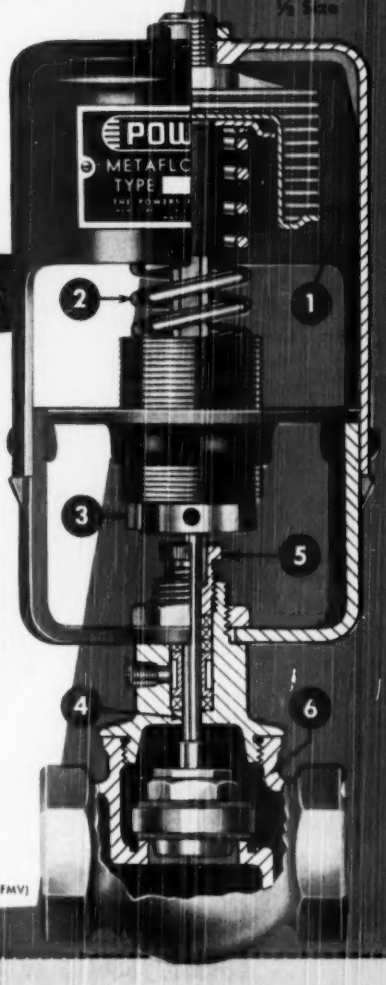
The Powers Regulator Co., pioneer in the development of the first all-pneumatic system of temperature control, now offers a new line of modern valves.

Check their many valuable features which can help you make important savings. Test and compare their superior performance with other valves. You'll find POWERS' valves moderately priced—often give more reliable operation over longer periods of time.

Contact our nearest office for further information or mail coupon below. THE POWERS REGULATOR CO., 2771 Greenview Avenue, Chicago 14, Ill. Offices in over 50 cities. Established in 1891.

Powers *Metaflow* Valves are small, sturdy, lightweight, reasonably priced, suitable for many control applications where space is limited and the pressure differential does not exceed 75 lbs. per square inch.

POWERS METAFLOW VALVE



SPECIFICATIONS

1. Housing and Bellows—Two sizes, 5" and 8" with specially formed brass bellows.

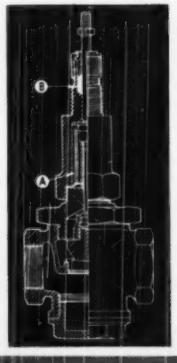
2. Spring—Cadmium plated. Calibrated to give full valve travel with 5 lbs. air pressure change.

3. Adjusting Screw—Brass, easily accessible. Has 15 lbs. adjustment range to give proper sequence operation where required.

4. Stem—Polished stainless steel.

5. Packing Gland—Specially formed packing with metallic jacket, grease sealed for long life and low hysteresis. Stem lubricator and variety of lubricants available as optional feature.

6. VALVES—Sizes: ½" thru 2"; bronze bodies with screwed ends, maximum body pressure 125 lbs., rugged construction to withstand piping strains. **TRIM**—Composition disc with brass integral seat and self-aligning disc holder. Available normally open (direct acting) or normally closed (reverse acting), and three way.



METAFLOW PACKLESS VALVES

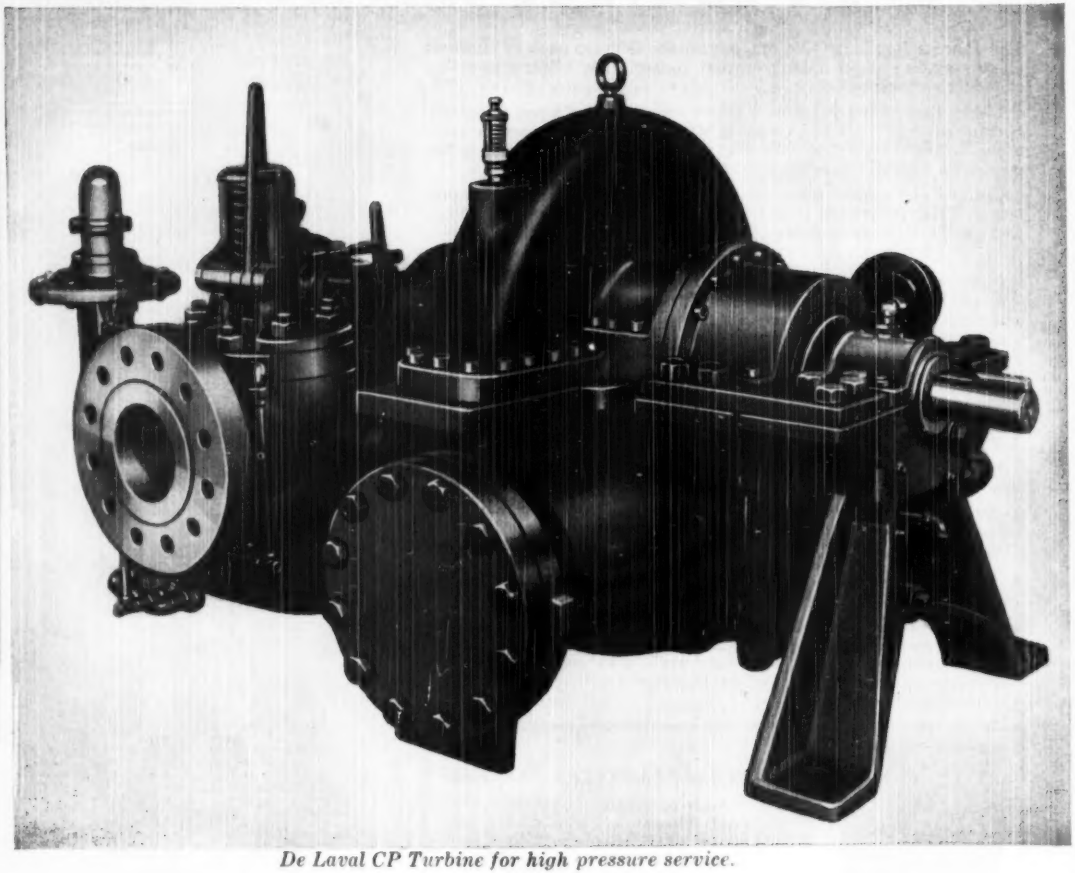
Prevent leakage of dangerous inflammable or harmful liquids or gases . . . . prevent waste and provide vacuum protection. Are suitable for use with Freon, oil, gasoline, non-corrosive gases, hot or cold water and low pressure steam. Have many uses in chemical plants, oil refineries, power plants, submarines and surface vessels.

Specifications: Direct acting valves (normally open); 125 lb. brass bodies, sizes ½", ¾", 1", 1¼"; stainless steel seats and poppets; stem seal (A) is made of specially formed flexible brass bellows. Auxiliary packing gland (B) provides additional safeguard.

Water Heaters, and Industrial Processes

THE POWERS REGULATOR CO., 2771 Greenview, Chicago 14, Ill.
Send futher information and prices on POWERS
☐ FLOWRITE VALVE ☐ METAFLOW VALVE ☐ Packless Type
☐ Control Instrument for _____ (Process or Operation)
Name _____ Title _____
Address _____
City _____ State _____

A NEW SINGLE-STAGE ESPECIALLY FOR HIGH



De Laval CP Turbine for high pressure service.

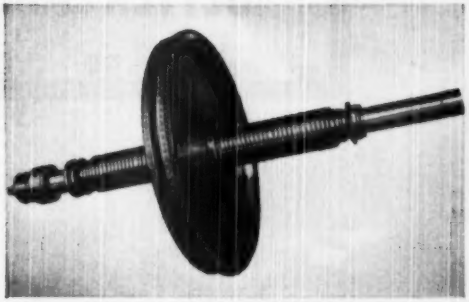
Initial Pressures to 1450 psig... Back Pressures to 300 psig

This new, high pressure single-stage turbine is designed for initial pressures to 1450 psig and back pressures to 300 psig. It is more than an ordinary single-stage turbine in a "beefed up" high pressure casing. It is the *first* single-stage, mechanical drive turbine with all labyrinth shaft seals of the type generally used in large, multi-stage turbines especially designed for high pressure service.

For more complete description and specifications,

Send for Bulletin 4215-33-P.

TURBINE DESIGNED PRESSURES



The FIRST Single-Stage Turbine with all-labyrinth shaft sealing

Steam leakage along the shaft is effectively prevented by a labyrinth seal consisting of a series of shaft grooves and mating tongues of stainless steel packing. The number of labyrinths in the shaft depends upon the exhaust pressure rating—as many as 52 labyrinths per side being employed for the highest pressures. These horizontally-split, spring-loaded segments of corrosion resistant labyrinth are held in T slots from which they can be removed and easily replaced.

The De Laval Labyrinth prevents leakage more effectively, reduces losses, lasts longer (because there's no rubbing contact) and requires less maintenance.

WHEN YOU BUY A DE LAVAL CP TURBINE YOU ALSO GET...

1. True center-line support

To provide for thermal expansion encountered in high temperature service, the turbine is supported at the exact centerline and the front end is mounted on a flexible channel. Because of this method of mounting both radial and axial expansion can take place without disturbing the shaft centerline.

2. Choice of eight governing systems

Eight different types of governors can be furnished including: mechanical shaft, vertical flyweight with or without oil relay, hydraulic with or without oil relay, pressure governors for pump and blower drives and auxiliary tripping devices.

3. Independent, positive over-speed trip

A separate, independent trip operating entirely independently of the governing system gives positive protection against over-speeding

4. Horizontally-split casing with steam chest in bottom half

The casing, packing glands and bearings are split at the centerline and the steam chest is located in the lower half of the casing so that the cover can be lifted without disturbing piping connections.

The De Laval CP Turbine is made in three sizes for capacities up to 2000 hp.

DE LAVAL STEAM TURBINE COMPANY
TRENTON 2, N. J.

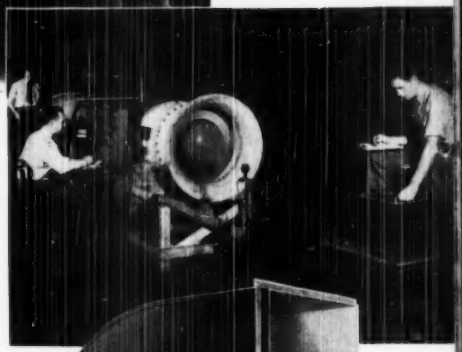
TURBINES • HELICAL GEARS • CENTRIFUGAL BLOWERS AND COMPRESSORS • CENTRIFUGAL PUMPS • WORM GEAR SPEED REDUCERS • IMO OIL PUMPS

T-33

FANATICS-TO GIVE YOU BETTER AIR SERVICE!

Below, Testing an Axial Flow Fan

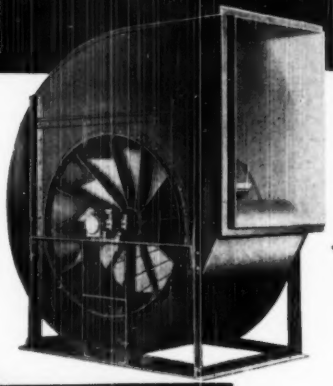
Below, the "Buffalo" Fan Test Room



THE ENGINEERING STAFF BEHIND EVERY "Buffalo" UNIT

● "Buffalo" Engineers literally eat, breathe and LIVE air, its applications and behavior! And from their laboratories in the "Buffalo" plant come daily developments that advance the performance and usefulness of fans and air conditioning units.

You benefit by this work when your business specifies a "Buffalo" Unit. You also benefit by the "Buffalo" Engineers in every principal city—for they are ready to work with your own Engineer on accurate selection of RIGHT equipment for the application. There's a "Buffalo" Engineer near you. *Write for his name and address.*

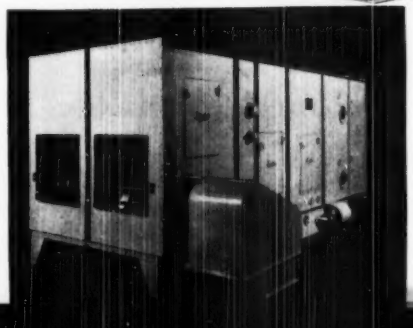


"Buffalo" FANS

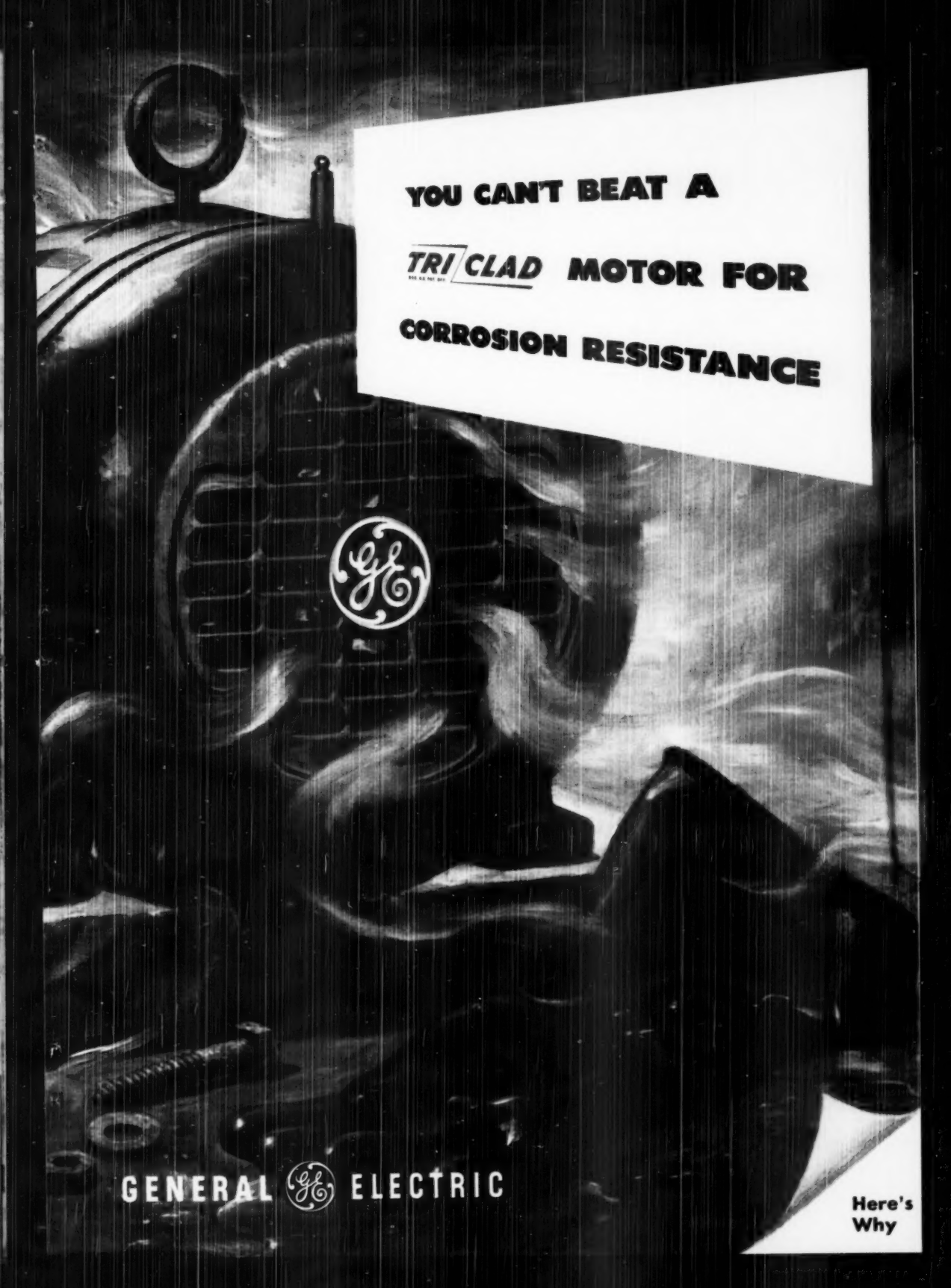
BUFFALO FORGE COMPANY

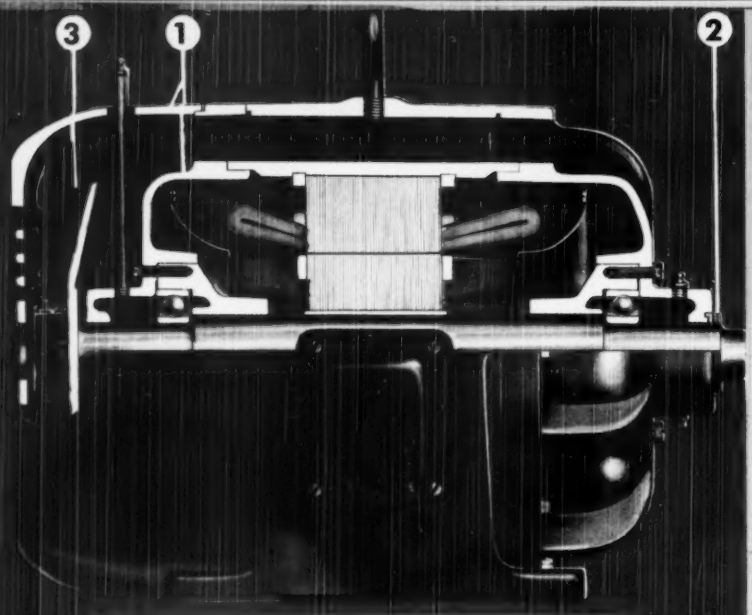
488 BROADWAY BUFFALO, N. Y.
Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

Branch Offices in All Principal Cities



"Buffalo" AIR CONDITIONING


YOU CAN'T BEAT A
TRI CLAD MOTOR FOR
CORROSION RESISTANCE
GENERAL ELECTRIC
Here's
Why



Here's the totally enclosed Tri-Clad double-shell structure (1) that locks out dirt, flying metal chips, abrasive dust and corrosive fumes. Check the rotating labyrinth seal (2) which prevents foreign matter from working in along the shaft. Note the cast-iron housing, the corrosion-resistant G-E Textolite* material cooling fan (3). Fan circulates cooling air between the shells—no contaminated air touches the punchings or inside parts.

You can't beat TRI/CLAD motors for corrosion resistance

Acid fumes, alkali dust, dye-house vapors, tropical weather – you name *your* motor "poison." You just can't beat Tri-Clad cast-iron construction for corrosion resistance.

Rolling up 6 billion hours of service on all kinds of jobs, more than 1,876,000 Tri-Clad motors tell the eye-opening story of cast-iron motor structure. You get an inherent damping action that minimizes noise and damaging vibration. You get rigidity that makes for permanent shaft alignment. (Try bolting a Tri-Clad motor to an uneven surface – the bolt will snap before you can twist the rigid frame out of line.) You get extra protection against jarring blows and rough handling. You get resistance to rust and corrosion that is not approached by any other metal used for standard motor construction today.

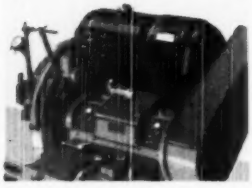
WANT MOTORS THAT STAY ON THE JOB ANYWHERE? There's a stock of Tri-Clad motors near you, in nearly all types and ratings, ready for **IMMEDIATE SHIPMENT.** *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

*Reg. U. S. Pat. Off.
(standard on popular sizes)

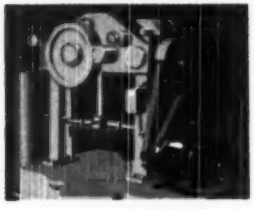
GENERAL ELECTRIC

YOU CAN'T BEAT TRI/CLAD EXTRA PROTECTION

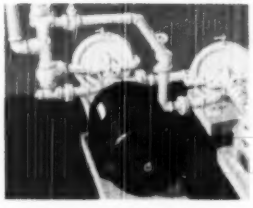
G-E capacitor motors for use on fans, blowers, pumps and compressors with single-phase power. From ¾ to 5 hp.



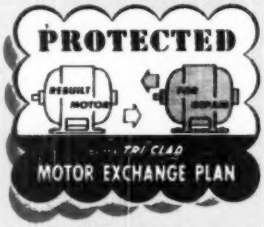
G-E Type ACA induction motors for adjustable speeds—provide speed ranges from 3-1 to 20-1. From 3 to 75 hp.



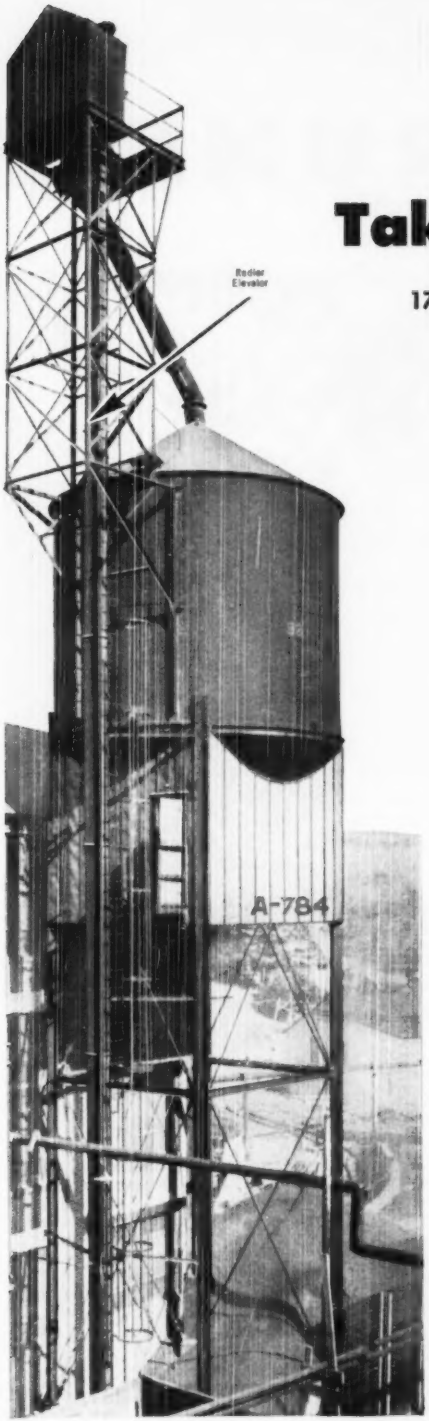
G-E open (dripproof) induction motors for constant-load, constant-speed applications. From 1 to 2000 hp.



G-E totally enclosed motors for outdoor operation, in abrasive dusts, or corrosive fumes. From 1 to 1000 hp.



Look for this EXTRA on the motor you buy!



Taking Coal for a Ride

17 FEET HORIZONTAL, 90 FEET VERTICAL IN ONE CONVEYOR

In one compact, yet rugged unit — with one drive — this S-A REDLER conveyor-elevator receives coal from cars and elevates it to a high storage bin from which it spouts directly into the boiler house by gravity. No need for a feeder under track hopper.

For nearly half a century S-A engineers have been designing and installing coal and ash handling systems for every kind of industry. From this wealth of experience have come constant improvement both in equipment and methods to give lowest cost bulk handling.

If you are faced with any kind of bulk materials handling problem, Stephens-Adamson engineers will gladly discuss it with you. Their recommendations will not obligate you. Write us today.

STEPHEN S-A DAMSON MFG. CO.

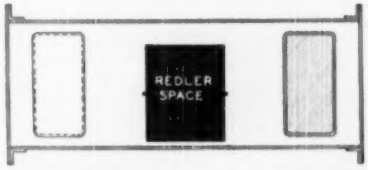
5 Ridgeway Avenue, Aurora, Illinois

Los Angeles, Calif. Belleville, Ontario

ATLAS POWDER COMPANY
WILMINGTON, DELAWARE

A REDLER conveyor-elevator moves coal from under a track hopper and elevates 90 feet to storage. Coal is elevated and stored quickly, in a minimum of space and at the lowest handling cost per ton. Cross section of REDLER casing through which coal moves with chain type conveying element, is only 10 x 12 inches. REDLERS are compact and require a minimum of supporting members yet handle practically any required tonnage. Write us for REDLER catalog 140 for complete details.

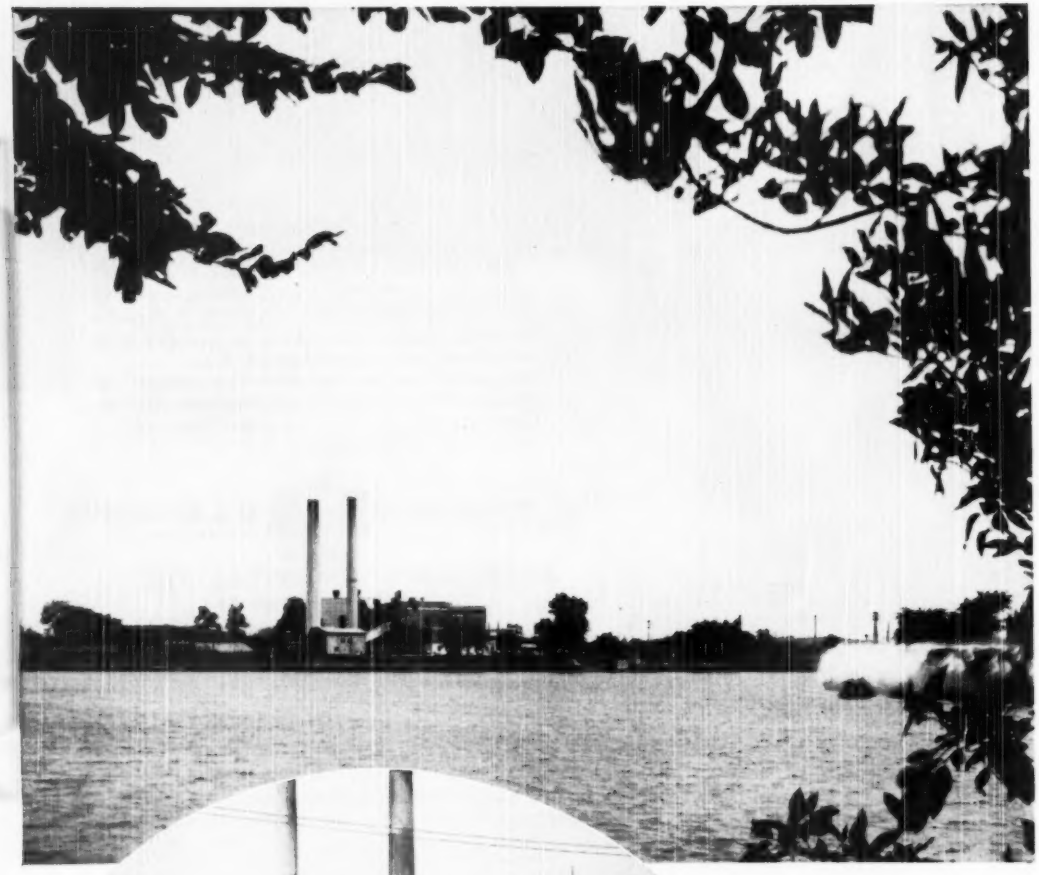
At right. Section drawing shows the relative sizes and space requirements of a standard bucket elevator and a REDLER elevator with the same handling capacity.



DESIGNERS AND MANUFACTURERS OF ALL TYPES OF BULK MATERIALS HANDLING EQUIPMENT

AT CENTRAL OHIO LIGHT AND POWER COMPANY...

it's ELECTRUNITE



Two exterior views of Central Ohio Light & Power Company's Electric Generating Station. An important factor in determining the location of this station when it was erected in 1937, was the adjacent 26-acre lake, water from which is used in the boilers.

BOILER TUBES

in Fifth Riley Stoker Installation

at Woodcock Electric Generating Station

Located 16 miles southwest of Findlay, Ohio, Woodcock Electric Generating Station furnishes electricity to an eighty-mile-long area of western Ohio . . . playing a vital part in the service provided by Central Ohio Light & Power Company.

Scheduled to go into operation in July of this year, this new 120,000 lb. of steam per hour boiler will augment the output of four similar Riley Stoker units installed since the station was erected in 1937.

About Republic ELECTRUNITE Boiler Tubes—used throughout all five units—Mr. R. A. Shumaker, Chief Engineer at Woodcock Station, makes the following observation: "During my twelve years of experience with ELECTRUNITE Boiler Tubes, I have never seen one split while being rolled-in. In two of our boilers none of the tubes were ever touched after they were rolled-in originally. In twelve years, we have replaced only three tubes."

Here, again, is positive proof of the satisfaction and dependability that go with every shipment of modern ELECTRUNITE Boiler Tubes. Like the tubes themselves, the results are *always uniform.*

Whether you are buying new boilers or planning to retube existing units, you'll find it well worth the time to investigate the cost-cutting advantages of ELECTRUNITE Tubes. Write today.

REPUBLIC STEEL CORPORATION
STEEL AND TUBES DIVISION • CLEVELAND 8, OHIO
Export Department: Chrysler Building, New York 17, N. Y.

Interior of the new Riley Stoker Corp. steam generating unit—designed for operation at 500 lbs. pressure and 835°F. temperature.

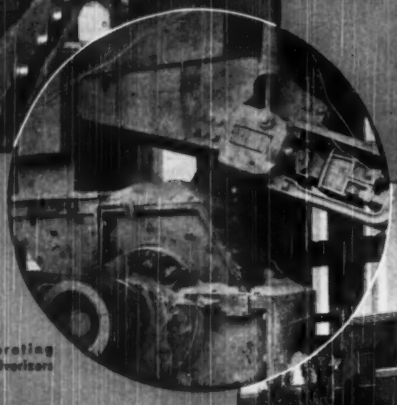
Republic
REPUBLIC STEEL
ELECTRUNITE
BOILER, CONDENSER AND HEAT EXCHANGER TUBES

FOR SERVICE THROUGH THE YEARS

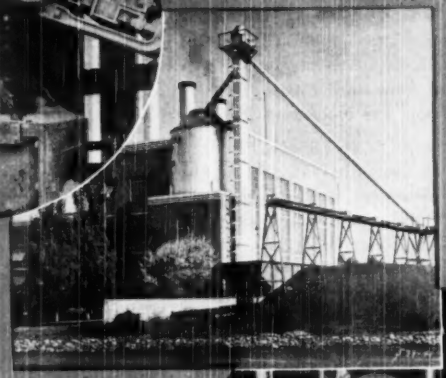
Jeffrey MATERIAL HANDLING EQUIPMENT

Handling costs are to be found in most unexpected places. The task of detecting all of these, applying remedies and co-ordinating them with the manufacturing scheme, requires specialized skill and experience. Jeffrey has been building material handling equipment for seventy years . . designs almost every type . . some that cannot be obtained elsewhere. Our engineers have built up in those years the experience and skill . . have the resources of devices and material . . to throw wide open a vast source of potential cost reduction. Give us the opportunity to show you.

Steel apron conveyor. (Also wood apron conveyors)

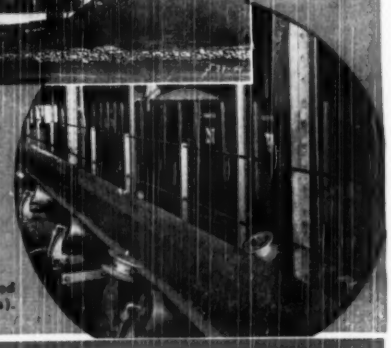


Electric vibrating feeders and pulverizers



FOR HANDLING LARGE QUANTITIES OF BULK MATERIAL. A CONSTANT, UNINTERRUPTED FLOW

Coal and ashes handling — bucket elevators, conveyors, weigh larries, skip hoists, crushers, car pullers, etc.



Belt conveyors (troughed or flat belt types).

THE JEFFREY MANUFACTURING COMPANY

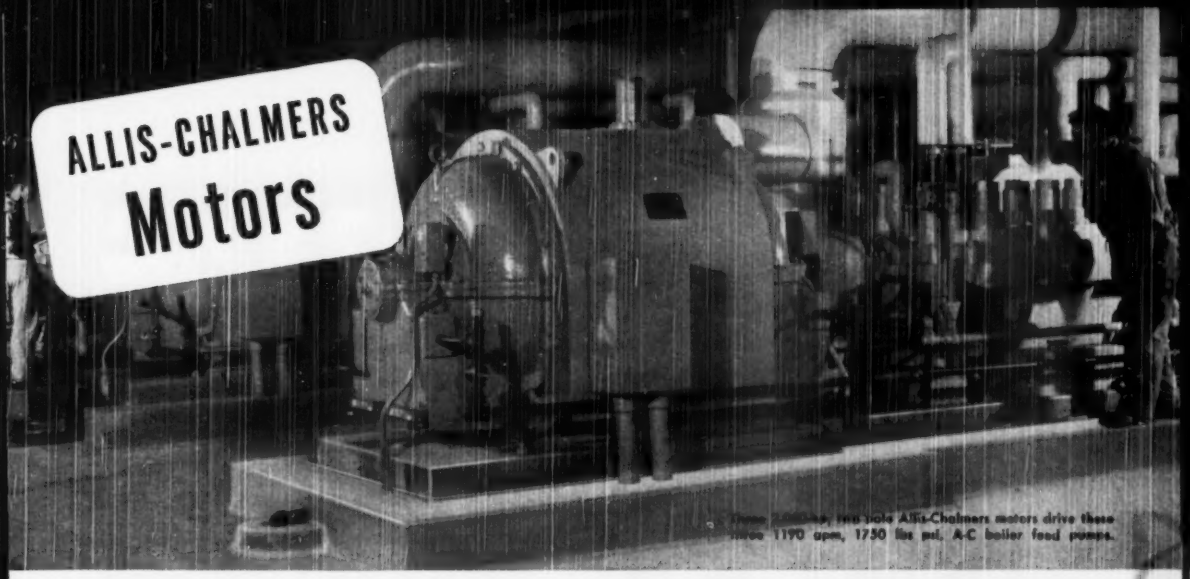
ESTABLISHED 1877

932 North Fourth St., Columbus 16, Ohio

Complete Line of Material Handling, Processing and Mining Equipment

JM

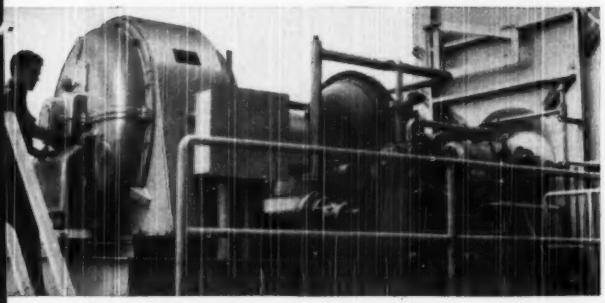
ALLIS-CHALMERS
Motors



Three 2,000-hp, two-pole Allis-Chalmers motors drive these three 1190 gpm, 1750 lbs psi, A-C boiler feed pumps.

At The Dayton Power and Light Company

for BIG auxiliaries, where reliability comes first

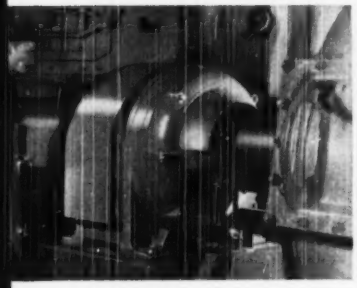


Induced draft fan being driven through hydraulic coupling by 1200-hp Allis-Chalmers outdoor splash-proof cage motor.

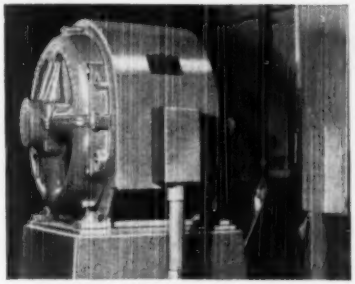
IN THE SPARKLING new O. H. Hutchings Station of The Dayton Power and Light Company, Dayton, Ohio, you'll see Allis-Chalmers motors at all vital points. These motors represent only a part of the A-C equipment installed at Dayton, and only a small part of the broad line of products Allis-Chalmers builds for the electric power industry.

If you intend to modernize or enlarge your facilities remember that Allis-Chalmers motors — in fact all A-C equipment for power — offer: continuity of operation; a wide range of types and sizes; and low maintenance. Call your nearby Allis-Chalmers Sales Office, or write direct for more information about the equipment shown here. A-3052

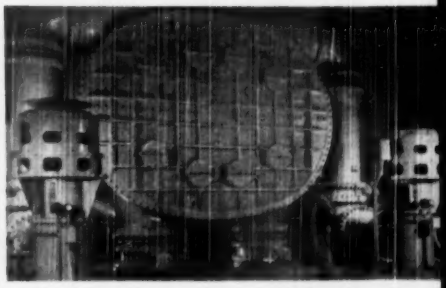
ALLIS-CHALMERS, 952A SO. 70 ST.
MILWAUKEE, WIS.



Six of these 250-hp cage motors are used for pulverizer mill and fan drives.

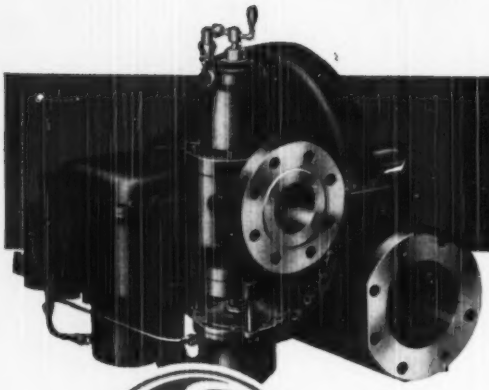


This 400-hp Allis-Chalmers cage motor is driving a forced draft fan.



Each condenser furnished with two 250-hp vertical motors and 21,650-gpm pumps . . . all by A-C.

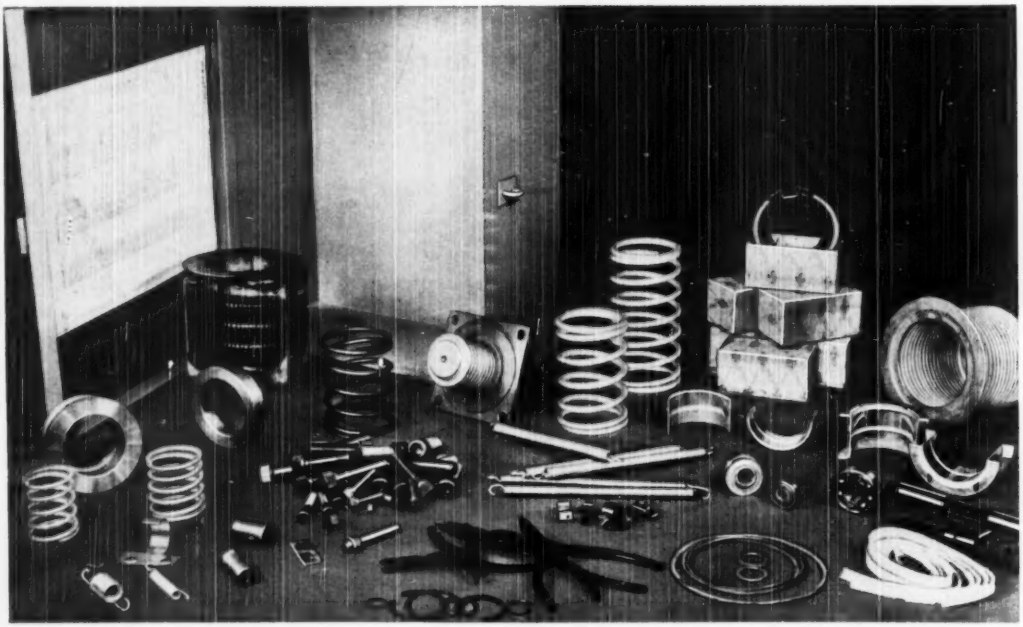
ALLIS-CHALMERS



SAVE

GE TYPE DP

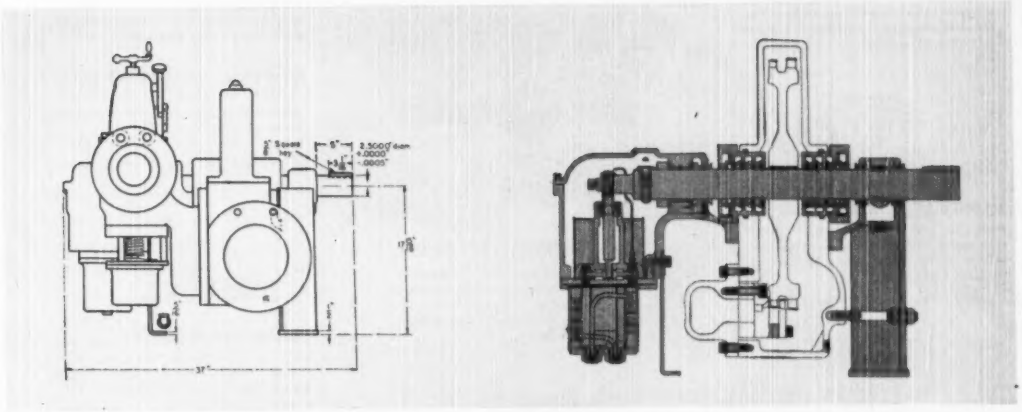
General Electric's DP turbines, available in three frame sizes and a variety of ratings, can be profitably used in many different applications, yet they compose a standard line and incorporate standard parts. This standardization gives you four important benefits:



1 EASY TO STOCK SPARES Because most parts are interchangeable on all models, spares can be stocked at low cost. A spare parts kit, containing 91 items, can be obtained with the turbine. This simple method of stocking spares lowers maintenance costs and provides protection for several DP's in your plant.

FOUR WAYS

WITH Standard Turbines



2 INSTALLATION SIMPLIFIED

All models, regardless of frame size, horsepower, or speed ratings, have identical shaft height, keyways, and coupling fits. Thus, installation problems are simplified, and you can move these center-line supported units from job to job without a "custom line-up."

3 GREATER FLEXIBILITY

As the shaded parts in the diagram illustrate, most DP parts are identical on all frame sizes and ratings. In this way, you can adapt a DP for different job requirements with only minor changes. A different nozzle plate gives you a different horsepower output. A change in governor gears provides a new speed range. When modernization programs demand a change in plant operation, the DP's flexibility will save you money.

4 A BETTER TURBINE

Manufacturing savings from standardization are passed on to you in the form of special features at no extra cost. For instance: hydraulic governing, combined trip-throttle valve, 30% speed range are advantages you'd expect to find only in custom equipment.

Ask your General Electric representative for full details about the DP mechanical-drive turbine or write for bulletin GEA-4955. Get the full details on how standardization will benefit your plant operation. Apparatus Department, General Electric Company, Schenectady 5, N. Y.

GENERAL ELECTRIC

252-45

THESE EDWARD DESIGN FEATURES

ALL ARE "FIRSTS"...MANY ARE "EXCLUSIVES" ...EACH MEANS A BETTER VALVE

INCLINED STEM VALVES First to build inclined stem forged globe stop valves and check valves. Edward construction eliminates turbulence, cuts wear, reduces pressure drop 25 to 30 per cent.

RADIUS STEM HEADS Radius of stem head assures application of closing load at center of disk. Curvature of inside of disk, in contact with stem head, centers disk for sure, tight seating.

FOOLPROOF STEM BACKSEATS Spherical stem or disk nut surface contacts taper bonnet surface to make a pressure-tight backseat. Exclusive with Edward.

UNIVALVE* BONNET JOINT Patented leak-proof welded body-bonnet joint assures perfect alignment of working parts, permits disassembly if ever necessary.

EVALIZING* Exclusive Edward process electroplates parts with wear-resistant metallic lubricous material. Reduces wear and friction between internal valve parts 50 per cent or more. Ideal for temperature service.

TAPER THREAD BONNET JOINT Taper threaded joint in small forged gage valves gives tight seal, withstands extreme pressures.

CROSS ARM IMPACTOR* HANDWHEEL Now the famous Edward impactor principle is applied to small valves. Easy-to-grip cross-bar delivers 2.8 times the closing load of ordinary handwheels. No wrenches or extensions needed.

FORGED STEEL FLANGED VALVE DESIGN Edward designed first forged valves with symmetrical, uniform wall thickness. Eliminates thermal distortion and stress, cuts needless weight.

SWING BOLT RETAINER New type retainers keep packing gland swing bolts in place on integral forged support pins, yet out of way for easy repacking.

NO-BONNET INSTRUMENT VALVE No chance for bonnet joint leak with these compact all forged valves for toughest instrument line service.

WELDED-ON FLANGES Edward patented first valve constructions using welded flanges. Permits super strong drop forged bodies with thin walls and proper fibre flow.

EVALPAK* PACKING Edward developed first asbestos-graphite packing with special processing to prevent stem pitting. Die molded, wire supported, low operating torque.

OTHER EDWARD FIRSTS! **Patented EValthrust* yoke bushings . . . Impactor* handwheels . . . Closure indicators . . . Low pressure loss cast steel body contours . . . Three-point disk guiding . . . Self-centering disk throttling lip . . . Free floating tubular disk-piston . . . Edward Equalizer* . . . Edward pressure-seal design . . . Intex* integral seats . . . Seat-located guide ribs in gate valves . . . Hour-glass type disk-piston . . . Separated feedline stop-check valves . . . Patented interchangeability of stop, check and non-return valves.**

Registered trade name of Edward Valves, Inc.

assure top FORGED STEEL VALVE VALUE

DON'T SETTLE FOR LESS!

Forged Steel valves, because they are small, sometimes don't get the attention they deserve when specifications are drawn.

But the smallest valves, if not equal to the service to which subjected, may be the most troublesome. Therefore, it pays to take the time to analyze design features and to study actual service records.

If you do, you'll find that Edward forged steel valves are the most copied in the field. You'll find that dozens of features that were Edward "firsts" are now accepted as industry standards. But you'll also find that there are still many patented features exclusive with Edward.

Edward pioneered *forged steel* valve construction, and Edward design developments have consistently been a step ahead of mounting service requirements, piling up outstanding service records in some of America's most famous power plants and process installations.

Don't discount experience. For steel valves for pressures from 150 to 7500 lb, expect the best *first* from Edward.

Edward

New design Fig. 444-448 series all forged steel globe and angle valves, 600 and 1500 lb sp, bolted or union bonnets, screwed or welding ends. Fig. 444 illustrated.

Edward

All forged steel welded bonnet Univalves®, 1500 and 2500 lb sp. Integral Stellited seat, Stellited disk, chrome-moly bodies, with permanent or removable backseats for disassembly in the line. Fig. 2224 illustrated.

Another Product

Edward Valves, Inc.

Subsidiary of ROCKWELL MANUFACTURING COMPANY

EAST CHICAGO, INDIANA

EDWARD VALVES, INC.
1220 West 144th Street, East Chicago, Indiana

Please send me Bulletins describing Edward forged and cast steel valves.

NAME_____

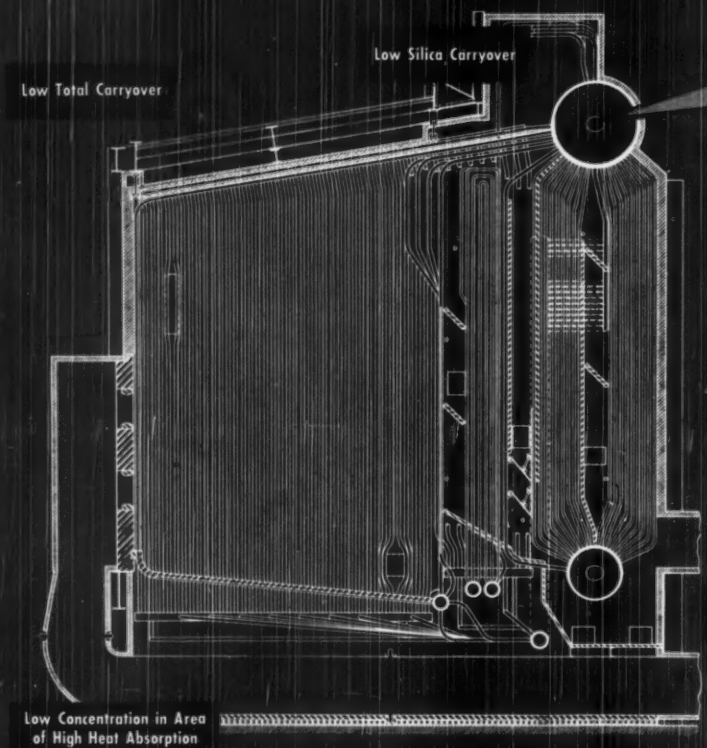
Street_____ Zone____ State_____

City_____

☐ Have Edward representative call.

high steam purity where it counts

Foster Wheeler Dual Circulation



Three FW Units for THE TEXAS COMPANY
LAWRENCEVILLE REFINERY
LAWRENCEVILLE, ILLINOIS

Steam Capacity
300,000 lb per hr

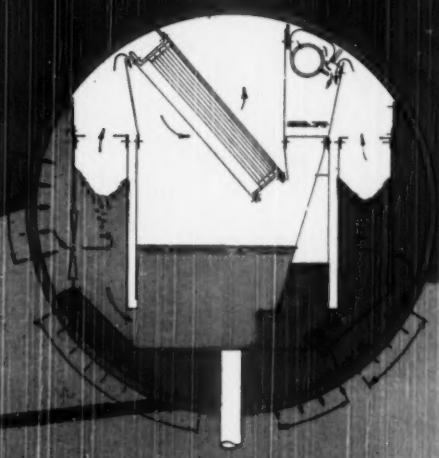
Superheat Control Range
150,000 to 300,000 lb per hr

Pressure Superheater Outlet
600 psi

Final Steam Temperature
750 F

Minimum Blowdown and Heat Loss

Steam Generators



Advantages for Both Central Station and Industrial Use

Under modern operating conditions of high pressure and temperature, the problem of steam purity is of increasing concern to the designers and operators of industrial and central station steam generators. Foster Wheeler engineers have successfully met this challenge by developing the Dual Circulation Steam Generator which already provides materially *higher availability, improved efficiency, and lower maintenance of high pressure steam turbines* at one large midwest refinery. Particularly in installations which have high makeup requirements, the Dual Circulation Steam Generator is capable of providing steam of higher purity with less blowdown than is possible in a conventional unit. In units operating on condensate, total solids and especially silica carryover are almost negligible with this design.

Design Features of Dual Circulation Steam Generator

The Foster Wheeler Dual Circulation Steam Generator consists of two separate heat absorbing sections each with its own independent circulating system. The feedwater goes to the primary, high duty, radiant heat absorbing section, which is continuously blown down into the low duty secondary convection section. Most of the steam is generated in the primary section where silica and boiler water concentrations are low. Thus, a marked reduction in the amount of silica carryover in the steam to the prime mover is achieved and tube damage is held at a minimum.

The Texas Company Orders Three Units for Lawrenceville Refinery

Because of adverse water conditions at the Lawrenceville Refinery, The Texas Company ordered three units, designed for high makeup with high concentration in its makeup. The Lawrenceville project is part of the present construction program in which all crude units are being engineered and constructed by Foster Wheeler.

For further information, write:

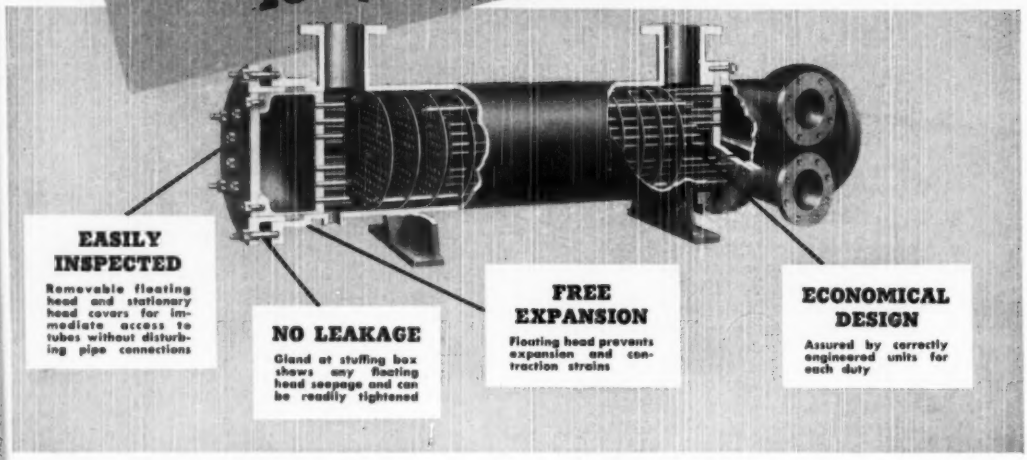
FOSTER WHEELER CORPORATION, 165 BROADWAY, NEW YORK 6, NEW YORK

FOSTER WHEELER

USE

G-R MULTIWHIRL COOLERS for cooling

- LUBRICATING OIL
- TRANSFORMER OIL
- DIESEL JACKET WATER
- CIRCULATING WATER
- WASTE LIQUORS



EASILY INSPECTED

Removable floating head and stationary head covers for immediate access to tubes without disturbing pipe connections

NO LEAKAGE

Gland at stuffing box shows any floating head seepage and can be readily tightened

FREE EXPANSION

Floating head prevents expansion and contraction strains

ECONOMICAL DESIGN

Assured by correctly engineered units for each duty

These important advantages of the G-R Multiwhirl Cooler for cooling . . . for heat recovery . . . on many liquid services have been proven in thousands of installations. They indicate some of the reasons why these units assure effective heat transfer and lastingly satisfactory service with greatest convenience and least expense for attendance and maintenance.

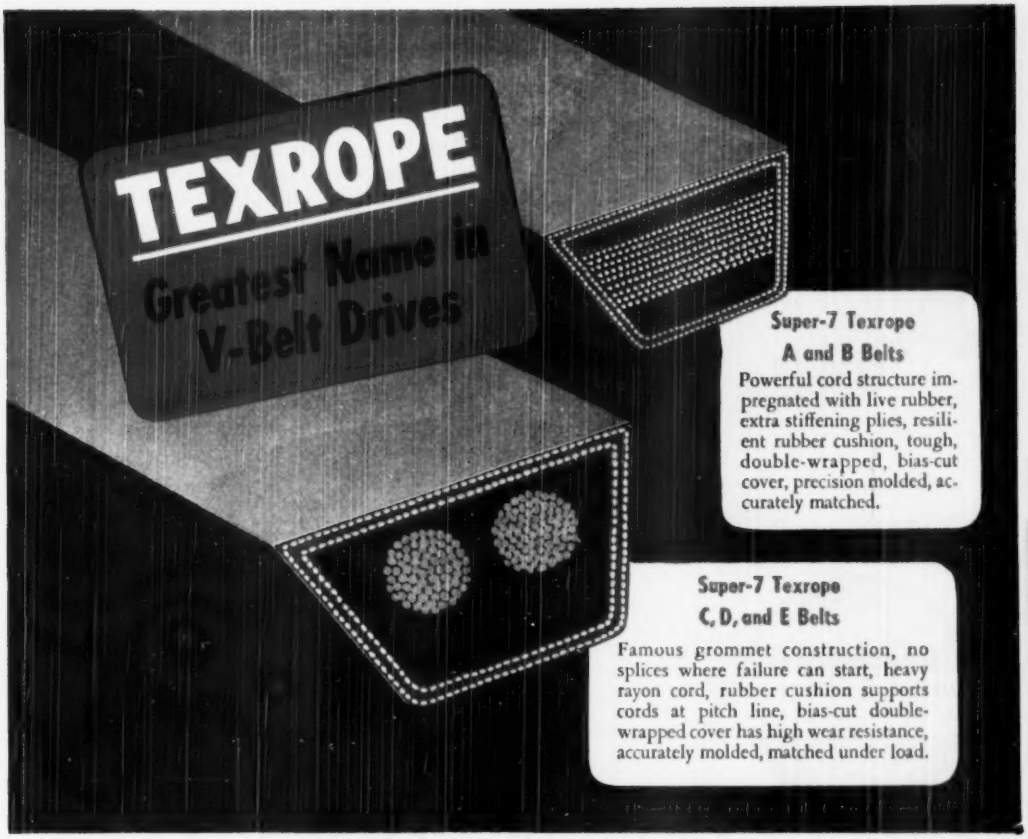
If your power-generating equipment or plant processes require cooling of liquids, be sure to investigate the G-R Multiwhirl Cooler. Write for bulletin describing these units in detail.

THE GRISCOM-RUSSELL CO.
285 Madison Ave., New York 17, N. Y.

GR-197

GRISCOM-RUSSELL

Pioneers in Heat Transfer Apparatus



Super-7 Texrope A and B Belts

Powerful cord structure impregnated with live rubber, extra stiffening plies, resilient rubber cushion, tough, double-wrapped, bias-cut cover, precision molded, accurately matched.

Super-7 Texrope C, D, and E Belts

Famous grommet construction, no splices where failure can start, heavy rayon cord, rubber cushion supports cords at pitch line, bias-cut double-wrapped cover has high wear resistance, accurately molded, matched under load.

LONG LIFE FOR YOUR DRIVES

YOU GET MORE than good belts when you standardize on *Super-7 Texrope* V-belts in your plant. You also get the benefit of the greatest V-belt experience in the world. This means you are sure of exactly the right drive for longest life on your job. *Texrope* Drive Department of Allis-Chalmers originated the multiple V-belt drive and there are more *Texrope* multiple V-belt drives in operation than any other make.

High Capacity Belts

These belts have extra strong cords, special rubber cushion and tough neoprene cover to give them 40% greater capacity than standard belts at proportionately higher price. Recommended only for applications where space is limited or other special conditions demand a heavier duty belt. Made in A, B, C, D and E sections.

Complete V-belt Service

Get everything you need for your V-belt drives . . . new and replacement V-belts, standard and variable speed sheaves and speed changers . . . from one reliable source. 144 page *Texrope* Pre-engineered Drive manual covers 90% of requirements. Get your copy today from your A-C Authorized Dealer or Sales Office or write for Bulletin 20B6956.

Texrope and *Super-7* are Allis-Chalmers trademarks. *Super-7 Texrope* V-belts result from the cooperative research of Allis-Chalmers and B. F. Goodrich; and are sold only by A-C dealers and offices.

ALLIS-CHALMERS, 952A SO. 70 ST. A-3021
MILWAUKEE, WIS.

Sold . . .
Applied . . .
Serviced . . .

by Allis-Chalmers Authorized Dealers, Certified Service Shops and Sales Offices throughout the country.

MOTORS — ½ to 25,000 hp and up. All types.

CONTROL — Manual, magnetic and combination starters; push button stations and components for complete control systems.

PUMPS — Integral motor and coupled types from ¾ in. to 72 in. discharge and up.

ALLIS-CHALMERS

"Not a Single Solenoid Has Burned Out On Our Water Valves Since We Protected Them With FUSETRON dual-element FUSES"

"During the winter of 1948-49 solenoids on five of our water valves burned out due to freezing of the water.

"The replacing coils alone cost us about $50.00 but the labor and operating loss ran much higher.

"To prevent these losses we installed a Fusetron dual-element fuse to protect each coil.

"During the winter of 1949-50 we did not lose one single coil due to burnout — but we did blow quite a few Fusetron fuses.

"The cost of replacing these Fusetron fuses was nothing to the loss we would of had if they hadn't blown."

E. C. Willy, Chief Electrician
H. J. Kaiser Aggregate Plant,
Pleasant, California

FUSETRON
TRUSTWORTHY NAMES IN ELECTRICAL PROTECTION
BUSS

Fusetron DUAL ELEMENT Fuses

give 10-point protection

1 Protect against short-circuits.
2 Protect against needless blows caused by harmless overloads.
3 Protect against needless blows caused by excessive heating — lesser resistance results in much cooler operation.
4 Provide thermal protection — for panels and switches against damage from heating due to poor contact.
5 Protect motors against burnout from overloading.
6 Protect motors against burnout due to single phasing.
7 Give DOUBLE burnout protection to large motors — without extra cost.
8 Make protection of small motors simple and inexpensive.
9 Protect against waste of space and money — permit use of proper size switches and panels.
10 Protect coils, transformers and solenoids against burnout.

Fusetron DUAL ELEMENT Fuses

Give All-Purpose Protection

because . . . The fuse link element opens on short-circuit — the thermal cutout element protects on overloads — the result, a fuse with tremendous time-lag and much less electrical resistance.

They have the same degree of Underwriters' Laboratories approval for both motor-running and circuit protection as the most expensive devices made.

Made to the same dimensions as ordinary fuses — fit all standard fuse holders.

Obtainable in all sizes from 1/10 to 600 ampere, both 250 and 600 volt types. Also in plug types for 125 volt circuits.

Their cost is surprisingly low.

Don't Risk Losses

One burned out solenoid
One needless shutdown
One lost motor
One destroyed switch or panel

may cost you far more than replacing every ordinary fuse with a FUSETRON dual-element fuse.

Mail the Coupon Now

for complete information about Fusetron fuses and their 10 point all-purpose protection.

FUSETRON is a trade-mark of the Bussmann Mfg. Co., Division of McGraw Electric Co.

Bussmann Mfg. Co., University at Jefferson
St. Louis 7, Mo. (Division of McGraw Electric Co.)

Please send me complete facts about FUSETRON Dual-Element FUSES.

Name .....
Title .....
Company .....
Address .....
City & Zone ..... State 950

Continuing Metallurgical Study Produces Major Savings For Utilities

BACK some ten years ago, Kellogg's metallurgists, working with the turbine manufacturers, discovered that carbon-moly steel, which had been "killed" with less than half a pound of aluminum per ton, could readily be heat-treated at lower temperature to achieve the desired uniform acicular grain size for optimum elevated temperature strength.

This was, naturally, important as the demand grew for piping to withstand operating temperatures up to 950° F. But even more important was the later discovery that this steel showed practically no graphitization at this temperature. As a matter of fact, when graphitization troubles hit the utility industry in general during the early forties, *Kellogg* carbon-moly installations using this steel were found to be unaffected. Obviously this meant a saving of hundreds of thousands of dollars for those utility companies that had followed Kellogg carbon-moly specifications.

Today, to prevent graphitization at even higher temperatures (up to 1050° F.) chrome-moly steels have been generally adopted by the industry for main steam piping.

Functioning in the same pattern as they did a decade ago, Kellogg's metallurgical groups are currently working toward pin-pointing the *minimum amount* of chromium that can be used successfully in high temperature piping.

Specific and continuing development work is one of the many advantages that utility companies gain when they specify M. W. Kellogg high temperature and high pressure piping.

Illustrated — *photomicrograph (500 m.) of specimen indicating presence of graphitization.*

To master temperature and pressure use

M. W. KELLOGG

piping and process equipment

Special studies of unusual problems such as graphitization to assure long life and low maintenance.

Metallurgical research by recognized specialists who have made major contributions in this field.

Exclusive Equipment for accurately analyzing stresses in piping and providing unique data for critical installations.

Complete facilities for the fabrication of steel products from simple forgings to specially cast bi-metallic devices.

Top welding performance in shops and in the field by welders accustomed to working under X-Ray checks.

Quality control, devised by metallurgical experts, embracing forming, heat treating and non-destructive testing.

Vessels
Exchangers
Condensers
Process Piping
Forged and Welded Fittings
Radial Brick Chimneys

★

The M. W. Kellogg Company, Inc. (A Subsidiary of Pullman, Inc.) — Offices in New York, Jersey City, Buffalo, Los Angeles, Tulsa, Houston, Toronto, London and Paris

IT'S WHAT YOU DON'T SEE THAT Cripples POWER PLANTS!

You run the risk of lowered efficiency — even plant shutdown — when you fail to protect your power generation equipment against attacks of scale, embrittlement, carry-over and corrosion! The following Allis-Chalmers corrective chemicals, recommended and applied by specialized water-conditioning engineers, are available to solve all of *your* costly water and steam troubles.

AKON TREATMENT — An effective oxygen absorbent and sludge coagulant for boilers, either internally or externally treated.

AKON BRICKS — A solid composed of Akon treatment and softening chemicals for internal treatment in low to medium pressure ranges.

No. 26 INTERNAL TREATMENT — Used as oxygen scavenger and sludge dispersive agent for boilers, either internally or externally treated.

No. 30 SERIES — Powdered formulations combining all of the necessary softening chemicals with an organic dispersive material.

SILIMITE TREATMENT — Effective high magnesium dolomitic lime for silica reduction in connection with a hot process lime-soda softener.

No. 40 SERIES — Powdered formulations for scale and corrosion control as supplementary treatment for boilers in *all* pressure ranges.

No. 160 SERIES — A liquid formulation consisting of the volatile amines for corrosion control in condensate return systems.

No. 20 SERIES — Powdered formulations designed to control excessive scale and corrosion problems in plant cooling cycles.

No. 60 SERIES — Powdered formulations for inhibiting corrosion in brine and circulating water systems and low pressure boiler plants.

A-C ANTI-FOAM — An effective formulation to overcome damaging foaming in power plant boilers operating over 150 psig.

HENRY W. FINK, with over 10 years experience in power plant water conditioning, is one of the Allis-Chalmers specialists located around the country to advise you on correct water conditioning equipment, chemicals and service. For free survey, call your nearby Allis-Chalmers office.

FOR OVER HALF A CENTURY, Allis-Chalmers has been building power generation equipment. This experience provides our water conditioning specialists with the extensive background needed today to recommend, not only correct equipment, but chemicals and service as well.

Whatever your industry — paper, petroleum, food, steel — an expert Allis-Chalmers representative is available, ready to recommend proper chemicals or help select the right process for your power plant requirements. Get in touch with him today at your nearby Allis-Chalmers Office.

Akon and *Silimite* are Allis-Chalmers trademarks.

ALLIS-CHALMERS

Water Conditioning

✓EQUIPMENT ✓CHEMICALS ✓SERVICE

ALLIS-CHALMERS, 952A SO. 70 ST. MILWAUKEE, WIS.

Gentlemen:

Please send me specific information on the following chemicals:

_____

_____

Name _____

Title _____

Company _____

Address _____

City _____ State _____ A-2983

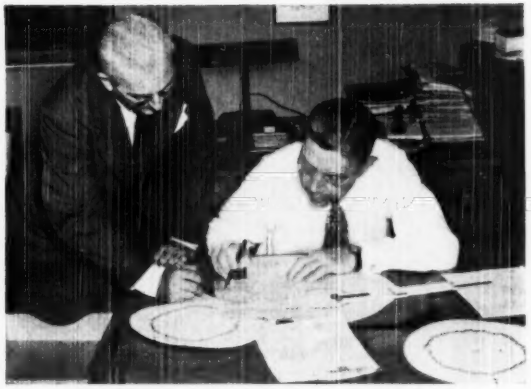
what results do you want from

your combustion

"Will this help solve a problem?" "Will it help get better results?" Hays research, project engineering, manufacturing methods, plant analyses, and service are constantly being evaluated in terms of these two queries. Responsible plant management and engineering personnel want "results" . . . high efficiency, rapid response to load swings, fuel savings, good CO_2 and low maintenance costs.

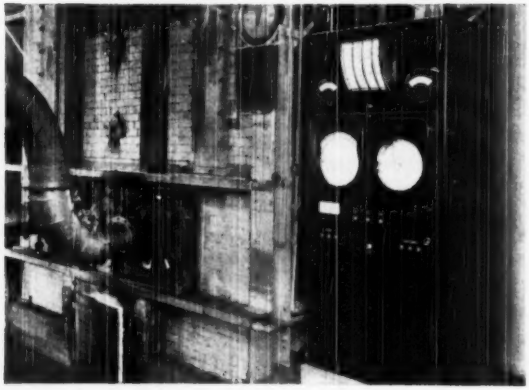
So we talk and think results. We apply this rule of thumb to our developing, producing, selling, and servicing, and help ourselves and the industries we serve.

Every power plant . . . every engineer faces specific problems and wants specific results. So Hays concentrates on actual plant problems and achieves definite results.



Increased efficiency? "Our basic reason for installing the Hays electric automatic combustion control was to obtain better efficiency. Our aim was more than reached . . . efficiency has climbed, attaining 79.3%." *Plant Engineer Manhattan Rubber Div., Raybestos-Manhattan, Inc.*

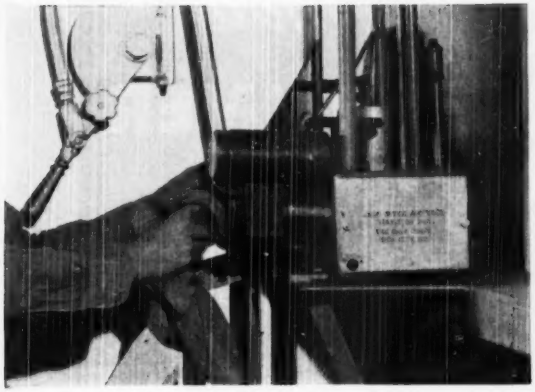
Rapid response to wide load swings? "We have made test runs using the Hays system, bringing the load rapidly up from 8,000 to 80,000 lbs. per hr. with excellent results. Fuel-air ratio was held at the desired value and CO_2 at 15%." *Chief Engineer of Power Plant, Bemis Bros. Bag Company*



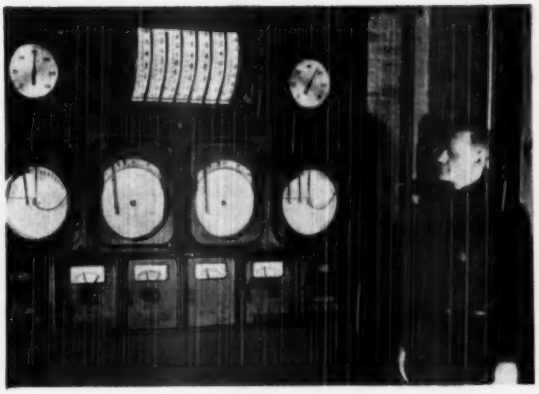
Good CO_2? "The (Hays) controls in combination with our instruments make it possible to maintain high efficiency, as indicated by the 14½% average CO_2 obtained, and keep complete records of our operation." *Chief Engineer, Geo. Ziegler Company*

Specific problems call for specific results. Here's proof that industrial plant management gets results as planned, with Hays Automatic combustion control systems.

control system?



Low maintenance? "Our aim has always been to eliminate the need for maintenance wherever possible . . . and we are particularly pleased that maintenance has been "nil" with the (Hays) automatic combustion control system."
Chief Engineer, Kurth Malting Company



Fuel savings? "Our fuel cost per pound of steam has dropped so much since we installed (Hays) instruments and combustion control, that fuel savings alone have been enough to pay for the investment in one year's operation."
Power Plant Chief Engineer, Vollrath Company

How to get results

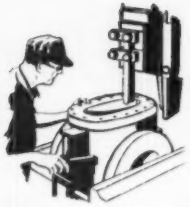
Hays application engineers will provide consultation on the special problems facing your plant. Through careful analysis, working with your actual operating conditions, they will recommend methods to achieve the results you want. Do you face any of these conditions?

- *Fuel savings—or special fuel problems*
- *Plans to meet increasing load demand*
- *Widely fluctuating loads*
- *Improving efficiency in your plant*
- *Problems in boiler and stoker maintenance*
- *Meeting smoke abatement ordinances*
- *Modernization of obsolete equipment*
- *Accuracy of control in processing*
- *Need for permanent records on combustion performance*
- *Other . . .*

Send for Bulletin No. 49-605 which describes how Hays equipment serves industry. For specific preliminary recommendations, without obligation, send us a brief statement of your combustion problem. Hays Corporation. Michigan City 3, Ind.

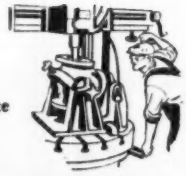
The Hays CORPORATION
MICHIGAN CITY INDIANA U.S.A.

AUTOMATIC COMBUSTION CONTROL • BOILER PANELS • FLOWMETERS • VERIFLOW METERS AND VERITROL • GAS ANALYZERS • DRAFT GAGES • COMBUSTION TEST SETS • CO_2 RECORDERS • ELECTRONIC OXYGEN RECORDERS • AIRFILTER GAGES



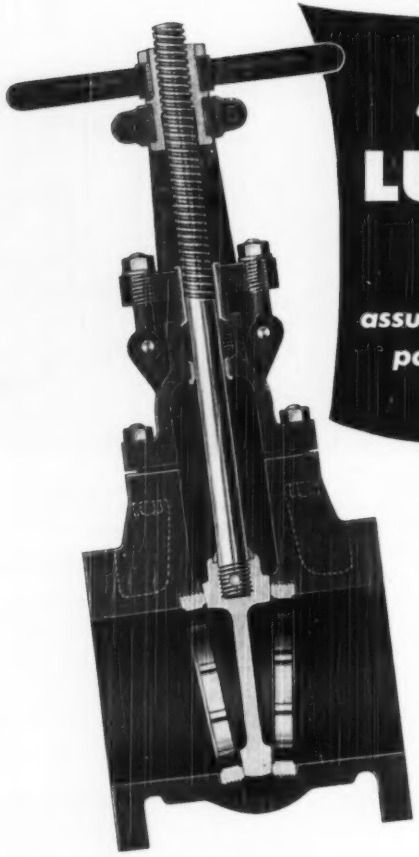
A DISTINCTIVE FEATURE IN DISC GUIDING

Body guides are machined **down to precision tolerances,** assuring a perfect guide **for the disc and creating a** positive center line on which all subsequent **machining operations** are based.



BODY PRECISION MACHINED TO INSURE PERFECT FIT OF SEAT RINGS

This operation makes inserting the seat rings **in a Lunkenheimer gate** valve simply a matter of screwing them into position. **Parts can** be replaced without any machine work or special fitting.



Precision Made

LUNKENHEIMER VALVES....

assure perfect-fitting, interchangeable parts . . . longer valve life . . . easier, lower-cost maintenance!

THE smooth working efficiency and low maintenance cost of Lunkenheimer Valves were not "made in a day." Behind this superior performance and economy lies long experience, top engineering and metallurgical facilities together with the most modern manufacturing equipment.

Lunkenheimer Valves have a streamlined simplicity of design . . . a minimum of working parts, each part of extra strength, correctly proportioned and perfectly balanced. This assures longer life with lower maintenance expense.

Fig. 1430 LUNKENHEIMER IRON BODY GATE VALVE

Fig. 1430 and complete line of I.B.B.M. and All Iron Gate Valves are described in Circular 564. Available from Lunkenheimer Distributors or direct.

ESTABLISHED 1862

THE LUNKENHEIMER CO.

"QUALITY"

CINCINNATI 14, OHIO, U.S.A.

NEW YORK 13 • CHICAGO 6 • BOSTON 10 • PHILADELPHIA 34

EXPORT DEPT. CINCINNATI 14, OHIO, U.S.A.

Simplicity of design . . .

Modern Facilities like this . . .

Through its continuous modernization program, Lunkenheimer provides the latest in manufacturing, engineering and research. New equipment of all kinds, the latest in machine tools, like the multiple spindle drill with hydraulic feed shown at right, assure ever higher accuracy, continually better products.

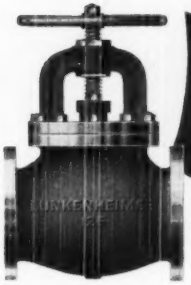


Fig. 1123 LUNKENHEIMER I.B.B.M. GLOBE VALVE

Globe and Angle Valves available in I.B.B.M. and All-Iron patterns — screw or flange ends.

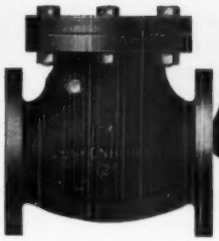


Fig. 1790 LUNKENHEIMER I.B.B.M. SWING CHECK VALVE

Swing Check Valves are available in I.B.B.M. and All-Iron patterns — screw or flange ends.

DEPEND ON YOUR LUNKENHEIMER DISTRIBUTOR FOR SERVICE AND REDUCED VALVE INVENTORY!

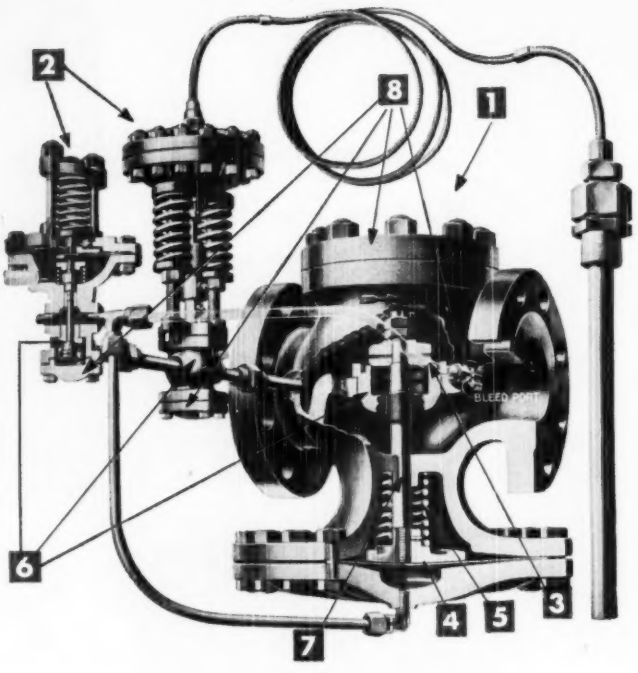
Many concerns, large and small, have found real savings by depending on the complete stocks of Lunkenheimer Distributors. Capital formerly tied up in slow-moving inventory is available for other uses; losses from obsolescence are eliminated or drastically reduced. Ask your Distributor how he can help you.

reduces maintenance costs!

NOW! CUT COSTS OF PRESSURE

These SPENCE features *show you how:*

YOU SAVE MONEY with Spence Self-Operated Regulators because they function dependably and accurately year after year *without requiring extensive repairs or special attention.* This long trouble-free life means less down-time of the system, less time and money wasted on replacement of parts. Thus, you lower over-all costs and, at the same time, are assured of quality performance.



The cutaway illustration above shows why Spence Regulators . . .

REGULATE ACCURATELY

1 The single-seated *packless* main valve is actuated by a large balanced diaphragm. The construction eliminates the need for closely fitted parts which may stick or bind due to uneven expansion or foreign matter.

2 One or more sensitive pressure or temperature pilots control the main valve.

Because the Spence design minimizes friction, accurate regulation remains unaffected by changes in service conditions or length of service.

STAY ON THE JOB FOR YEARS

3 SECO Metal Seats and Discs resist wiredrawing. More than 20 years of experience with SECO Metal in thousands of installations has failed to produce one single case where SECO Metal has been cut by steam.

4 Spence metal diaphragms, under usual conditions, never require replacement. Spence Regulators have few moving parts and those few are ruggedly constructed and seldom require attention.

5 The spring in the Spence Regulator is out of the path of the fluid flowing through the valve. It operates at low unit stress to assure performance over an unusually long life.

REDUCE MAINTENANCE

6 The seat and disc of the main valve and pilot can be cleaned and any working part removed, without taking the main valve out of the line.

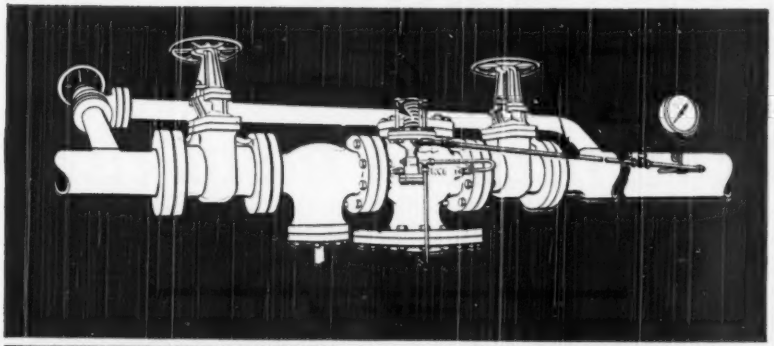
7 All main valves and most pilots are built without stuffing boxes. This packless construction eliminates much time-consuming maintenance.

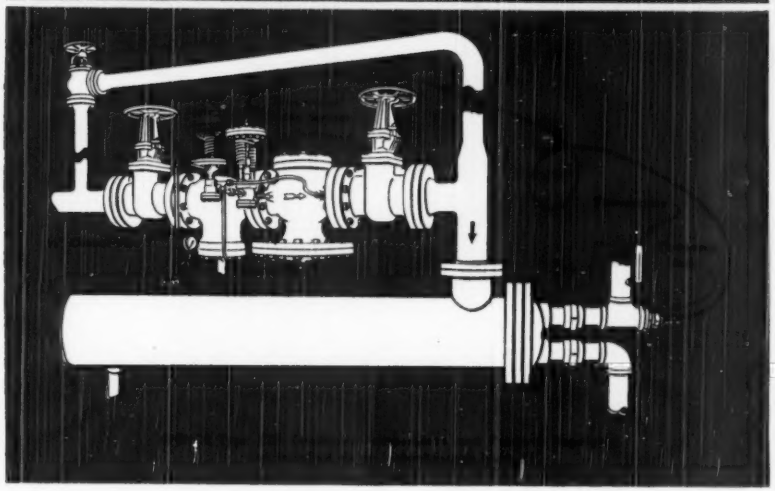
8 No dismantling is necessary to inspect the main valve disc, the pilot valve member and the SECO Metal bleedport. Special openings are provided. Inspection is easier, too, because the pilot is not an integral part of the main valve.

SPENCE ENGINEERING COMPANY, INC.

AND TEMPERATURE CONTROL

TYPICAL INSTALLATIONS





PARTIAL LIST OF USERS

- The Cleveland-Cliffs Iron Company
- Tennessee Coal, Iron and Railroad Company
- The Springs Cotton Mills
- Ford Motor Company
- Cochrane Corporation
- Philadelphia Electric Company
- Pennsylvania Power & Light Company
- L. H. Gilmer Company Div. of United States Rubber Co.
- York Corporation
- Jones & Laughlin Steel Corporation
- The Duluth Steam Corporation
- Rochester Gas and Electric Corporation
- Consolidated Gas Electric Light and Power Company of Baltimore
- Phenix Natural Gas Company
- Cutter Laboratories
- National Tube Company
- The Atlantic Refining Company
- Great Lakes Steel Corporation
- Union Electric Company of Missouri
- Todd Shipyards Corporation
- Oxford Miami Paper Company
- Land O'Lakes Creameries, Inc.
- Ohio Edison Company
- General Electric Company
- R. J. Reynolds Tobacco Company

HAVE UNUSUAL VERSATILITY

9 The Spence Regulator, due to its unique design, will serve many functions and will handle all the various types of fluids under a wide range of service conditions. One of the great advantages of this Spence design is the interchangeability of all pilots on all sizes of main valves. Any main valve can be changed from a pressure to a temperature regulator or vice versa *simply by substituting one type of pilot for another.*

Spence Regulators are built in sizes from ¼" to 12" for service with air, steam, water, oil or gas. With minor adjustments, any Spence Regulator can be easily switched from one service to another.

FREE BULLETIN gives complete engineering details and selection data. It features a full color, fully illustrated description of the operating cycle of a Spence Regulator. Send for your copy of this valuable bulletin today.

9

TYPICAL PRESSURE PILOT MODIFICATIONS AVAILABLE

Type	Delivery Pressure Range, PSI	Normal Accuracy + or −
D	3-150	1 PSI
D5	1-25	½ PSI
W	0-10	¼ PSI
W7	0-3	½ OZ

Spence

WALDEN, NEW YORK

Stop VALVE SHOPPING!

for BRONZE — IRON — STEEL — CORROSION-RESISTING Valves

POWELL *makes them all*

Fig. 3061—Class 300-pound Cast Steel Swing Check Valve with flanged ends and bolted cap. Disc has ample lift to permit full, straightway, unobstructed flow through the valve body.

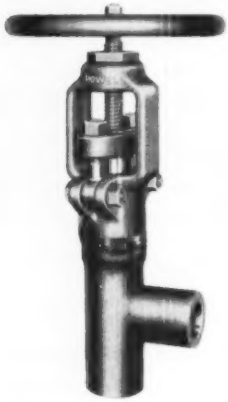


Fig. 1333-A—Class 1500-pound Steel Integral Bonnet Angle Valve with welding ends. Also available in Globe and "Y" patterns.

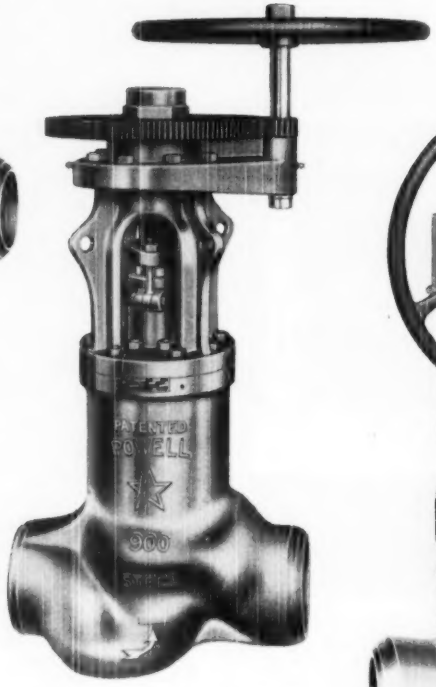


Fig. 19084 W.E.—Class 900-pound Cast Steel Pressure Seal Globe Non-return Valve with welding ends and spur gear operation. Improved streamline design reduces pressure drop and turbulence to the minimum.

Fig. 11313 W. E. — Class 1500-pound Cast Steel Pressure Seal Gate Valve with welding ends, venturied ports and special by-pass. Bevel gear operation. Also available with top-mounted electric motor operator.

POWELL

When you want to buy a new suit, you don't shop for the coat in one place, the vest in another, and the trousers in still another.

But that's just what you do if you get your bronze or iron valves from one source, cast steel valves from another and possibly special design or alloy valves from several others.

No one makes better bronze, iron or steel valves than we do. And, in the field of special design and alloy valves for corrosion-resistance, Powell has always led the way. Today Powell makes the *only* COMPLETE line of these valves available.

In short, Powell makes all kinds of valves* needed in your industry—and makes them better. So stop shopping for valves. Standardize on Powell . . . and centralize responsibility for the efficient operation of the entire flow control system in your plant.

Fig. 6003 W. E. — Class 600-pound Cast Steel Gate Valve with welding ends, outside screw rising stem, bolted flanged yoke and tapered solid wedge.

Fig. 1793—Large 125-pound Iron Body Bronze Mounted Gate Valve. Sizes 2" to 30", incl. Has flanged ends, bolted flanged yoke, outside screw rising stem and tapered solid wedge.

Fig. 150 — 150-pound Bronze Globe Valve with screwed ends, union bonnet and renewable composition disc.

Fig. 11323 W. E.—Class 1500-pound Cast Steel Pressure Seal Gate Valve with welding ends. Has top-mounted electric motor operator for quick positive opening and closing.

***The Complete Powell Line includes Globe, Angle, "Y", Gate, Check, Non-return, Relief, and Flush Bottom Tank Valves in Bronze, Iron, Steel and a wide range of Corrosion-resistant metals and alloys.**

Ask your nearest Distributor—or write direct

The Wm. Powell Company

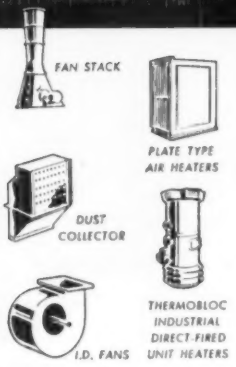
Cincinnati 22, Ohio

DISTRIBUTORS AND STOCKS IN ALL PRINCIPAL CITIES

VALVES

Look...NO STACKS!

P-D "Short Stacks" Become an Integral Part of This Michigan Power Plant



Here's modern industrial architecture at its best . . . a power plant with no protruding stacks.

This municipal power plant, close to the business district of Lansing, Michigan, was architecturally designed to give the appearance of a commercial building. Elimination of unsightly chimneys, an earmark of power plants, was accomplished by the use of specially designed P-D Fan Stacks, recessed into the actual building structure.

P-D Venturi type Fan Stacks are normally short, but these stacks were made even shorter by increasing the angle of the stack wall and dividing the stack with a baffle.

P-D Fan Stacks are a complete draft producing unit consisting of fan, breaching and stack, integrated to produce the highest efficiency attainable. Thus, predetermined draft efficiency can be guaranteed since all components are designed, engineered and manufactured by one company . . . The Prat-Daniel Corporation.

For the answer to your draft problem consult our project engineers . . . for modern, high induced draft efficiency, install P-D Fan Stacks.

Project and Sales Engineers **THE THERMIX CORPORATION** GREENWICH, CONN.

Canadian Affiliates: T. C. CHOWN, LTD., 1440 St. Catherine St. W., Montreal 25, Quebec

PRAT-DANIEL CORPORATION

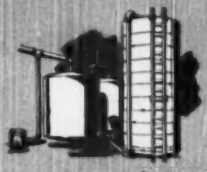
73-5 WATER STREET EAST PORT CHESTER, CONN.

DESIGNERS AND MANUFACTURERS OF POWER PLANT EQUIPMENT FOR OVER 25 YEARS

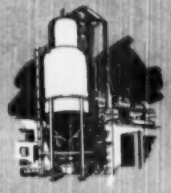
five basic power plant processes...

ZEO-KARB SOFTENER The Permutit Zeo-Karb® Softener removes both hardness and bicarbonates from raw water. The effluent is soft and reduced in total solids and alkalinity. The sulphate-carbonate ratio may be adjusted as desired by a system of mixed effluents.

SILICA REMOVAL PLUS DEMINERALIZATION Demineralization by cold ion exchange processes produces water of comparable quality to distilled water at a small fraction of the cost of distillation. Treatment by an anion exchange resin, Permutit S,® reduces silica to less than 0.5 ppm.



DEAERATING HEATER The Permutit Deaerating Heater, utilizing exhaust or bled steam, prevents corrosion of feed lines, stage heaters, economizers, and boilers by removing *all* oxygen and free CO_2. Capacities from 12,500 to 1,400,000 pounds per hour are in service.



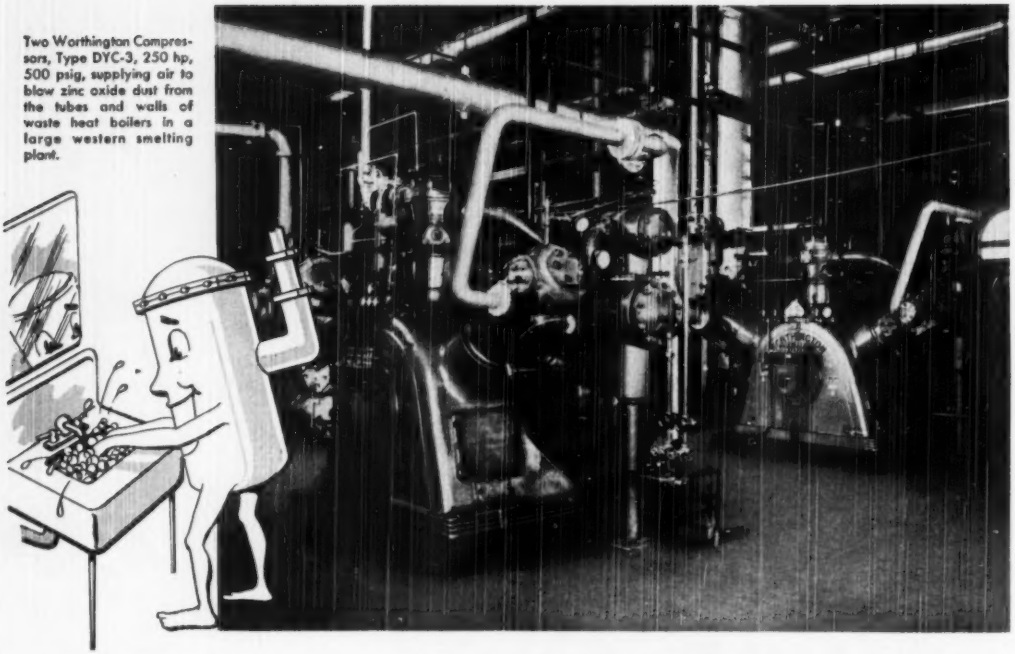
SLUDGE BLANKET HOT LIME SODA The application of the sludge blanket design to hot lime soda treatment gives you soft water of a low silica content. Lower turbidity eases the load on the filters... savings in operating costs are substantial.

PRECIPITATOR The Permutit Precipitator is used to lower alkalinity, reduce hardness, and help to remove turbidity. It can also be used to reduce silica.

Consult Permutit without obligation on any of these processes. Our know-how in water conditioning, backed by 37 years experience, can provide the answer to any water treatment problem. Write to The Permutit Company, Dept. P-5, 330 West 42nd Street, New York 18, N. Y., or to the Permutit Company of Canada, Ltd., Montreal.

Permutit

Water Conditioning Headquarters For Over 37 Years



Two Worthington Compressors, Type DYC-3, 250 hp, 500 psig, supplying air to blow zinc oxide dust from the tubes and walls of waste heat boilers in a large western smelting plant.

HOW TO DO A REAL SOOT-BLOWING JOB

... faster, better, at less cost!

Worthington Compressors Offer The Modern, Money-Saving Way To Make Your Boilers "Come Clean!"

Boiler cleaning by hand is a messy, makeshift carry-over from the horse-and-buggy era. Today, soot-blowing by compressed air is an economic necessity. Originally developed for low pressure boilers, air soot blowing has shown so many advantages over steam as a cleaning agent that its use has now extended to central stations and big power plants throughout the nation.

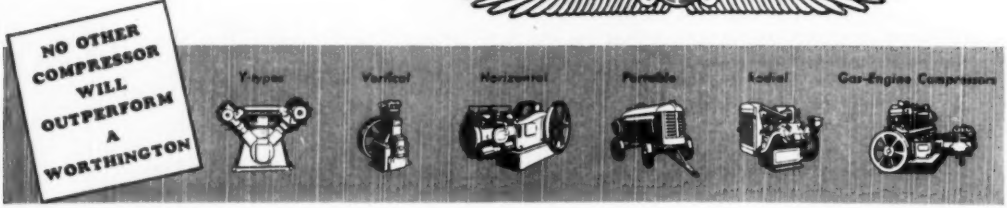
The reasons are plain. Air soot blowing saves fuel and feed-water make-up, while lessening the possibility of tube erosion. It uses inexpensive, low-temperature piping, with piping insulation eliminated. It reduces soot blower maintenance, provides a dryer blowing medium and a more effective means of slag removal. Finally, its complete adaptability to automatic control reduces costly manual operation throughout long years of service.

"Heart" Of Every Soot Blowing System

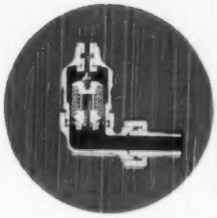
is its compressors . . . and Worthington builds these for every application . . . builds them to give you longer, quieter, smoother service — and air at lower cost. For further facts proving *there's more worth in Worthington*, write for booklet, "Worthington Compressors for Soot Blowing". *Worthington Pump and Machinery Corporation, Compressor Division, Buffalo, N. Y.*

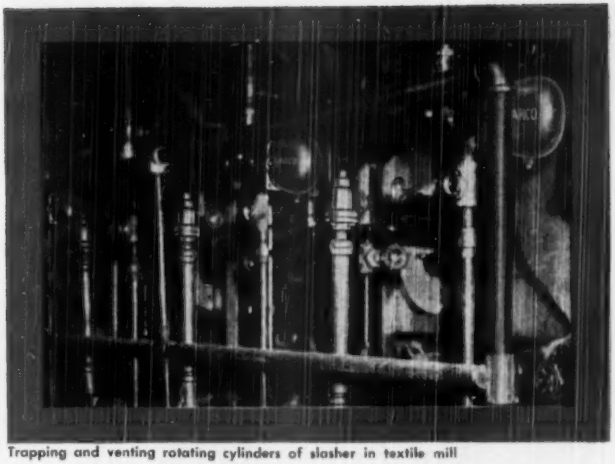
KO-6

WORTHINGTON



THE *Why* AND *How* OF AIR VENTING





Trapping and venting rotating cylinders of slasher in textile mill

Every steam man knows that air blocks steam lines, but too many executives do not realize what air in the lines and equipment is costing them, and how inexpensive the devices are that can remove it.

There are two vital reasons why air should be removed at the point where it collects.

First—an air steam mixture always has a lower temperature than pure steam at the same pressure. Steam temperature at 15 psi is 249°F, but mixing 50% of air would reduce this to 212°F, equivalent to 0 psi pressure.

Second; and more serious, the air collects on the heated surface and insulates it from the hot steam, reducing output.

THE SOLUTION

First, select the right steam trap. The Sarco No. 9 Thermostatic for instance is wide open when cold. It lets all the initial air out fast. Other Sarcos let air out too, but only at the point where they are installed.

So the next step is to put in Sarco Air Vents at suitable spots in the lines—at the farthest point from entry of steam in process equipment—and at many points in your heating lines.

This is a subject of renewed interest because Sarco has recently designed a complete line of vents and made available special technical data on the subject.

ASK FOR CATALOG No. 275

269

SARCO SAVES STEAM

SARCO COMPANY, INC.

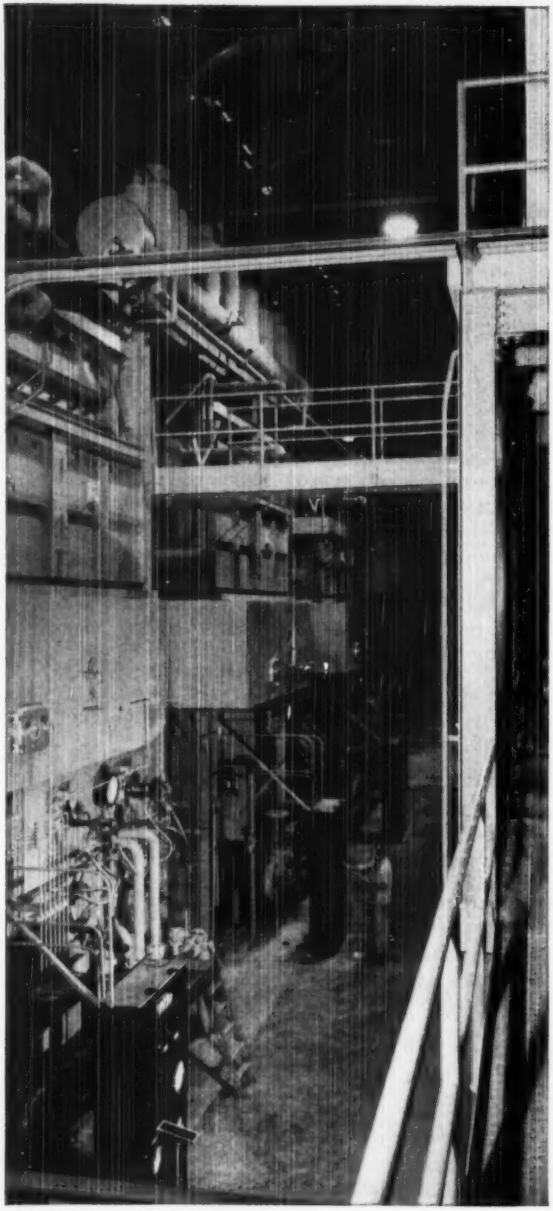
Represented in Principal Cities

Empire State Building, New York 1, N. Y.

SARCO CANADA, LTD., TORONTO 8, ONTARIO

IMPROVES PRODUCT QUALITY AND OUTPUT

COMBUSTION CONTROL



FOR
ALL SIZES OF BOILERS
ALL TYPES OF FIRING
ALL LOAD CONDITIONS

An automatic combustion control system, as designed and built by Republic, will enable you to operate your boiler (or boilers) over a long period at test efficiencies regardless of variations in fuel, load and other operating factors.

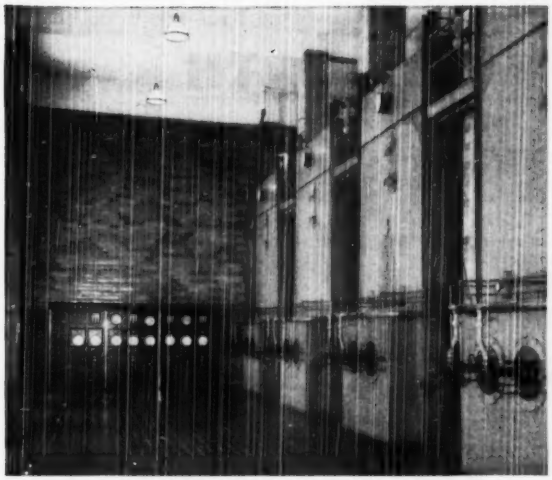
Republic combustion control is a unified system controlling simultaneously, in measured quantities and in correct proportions, the fuel and air input to the boiler.

It automatically increases or decreases the fuel and air supply to the boiler in the correct amount to maintain constant steam pressure and in the correct ratio to maintain maximum combustion efficiency.

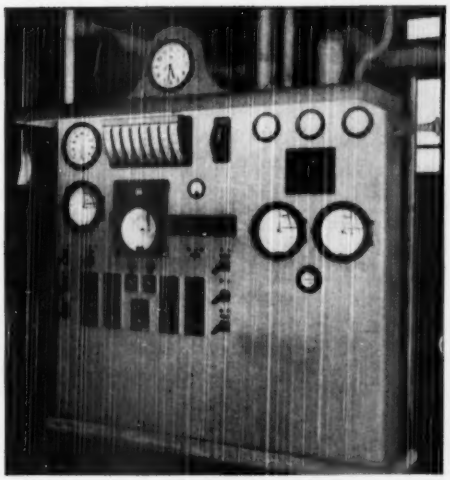
Republic automatic combustion control systems, either pneumatic or hydraulic, are available for all sizes of boilers, all types of fuel firing, and load conditions and any arrangement of draft equipment. They are completely described in Data Book No. S-21—write for your copy.

GAS FIRED—In this modern industrial plant steam is generated at the rate of 400,000 lbs. per hr. by four gas fired boilers operated by a Republic automatic combustion control system.

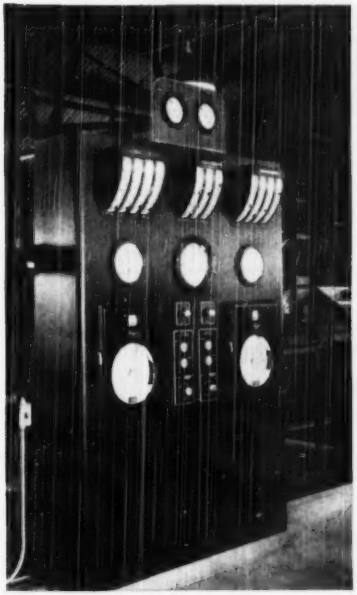
STOKER FIRED—The Republic instrument and combustion control panel for an 80,000 lbs. per hr., stoker fired boiler in a municipal power plant.



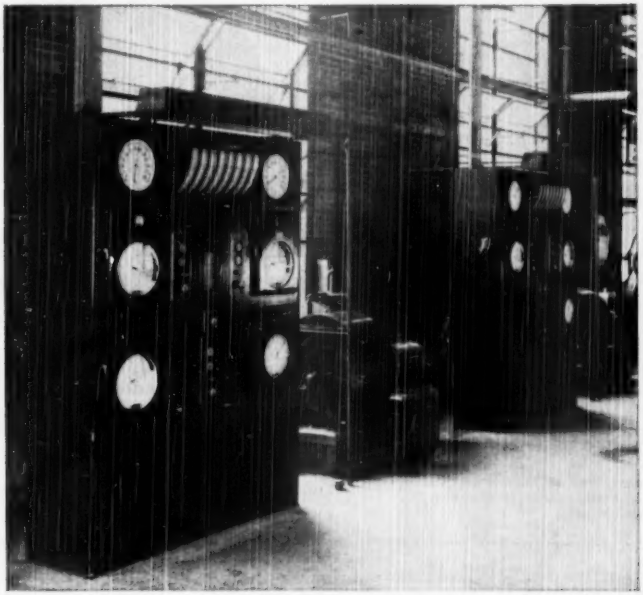
OIL AND GAS FIRED—In this model boiler room of a large institution the four combination oil and gas fired boilers are operated by a Republic automatic combustion control system.



STOKER FIRED—The Republic combustion control and instrument panel for the automatic operation of a 45,000 lbs. per hr. stoker fired boiler.

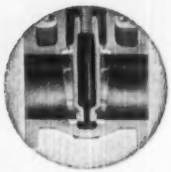


MIXED GAS—Republic instrument and control panel installed in a natural gasoline plant to automatically control two 50,000 lbs. per hr. boilers burning mixed gas.

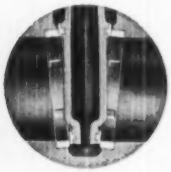


STOKER FIRED—A typical Republic combustion control installation in the boiler room of a mid-western university for the automatic operation of two 25,000 lbs. per hr. stoker fired boilers. All boiler instruments and manual controls are centralized on the two panels pictured above.

REPUBLIC FLOW METERS CO.
2240 Diversey Parkway, Chicago 47, Illinois

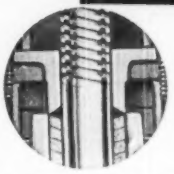


Straight-Flow Port Design reduces fluid turbulence to a practical minimum.



Seat Rings of end-seated type are screwed into the body.

Sure-Grip Malleable Handwheel for non-skid gripping even with heavy gloves.



Brass Liner on Glands assures greater resistance to corrosion and scoring.

WALWORTH

iron body gate valves

with screwed or flanged ends

... 8 Outstanding Features

For complete information on these new Walworth Iron Body Valves, see your local Walworth distributor, or write for bulletin 106.

WALWORTH

valves and fittings

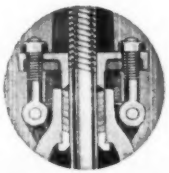
60 EAST 42nd STREET NEW YORK 17, N. Y.

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

T-head Disc-to-Stem connection on OS&Y types provides stronger connection, prevents loosening of disc by corrosion.

Bronze Back-Seat Bushings bonnets of OS&Y valves.

Solid Web Type Disc in OS&Y valves for greater strength and longer service.



Hinged Gland Eye-Bolts on OS&Y valves permit faster, easier repacking under full pressure.

POWER

P W SWAIN *Editor*
L N ROWLEY *Executive Editor*
F A ANNETT *Associate Editor*
J C McCABE *Associate Editor*
B G A SKROTZKI *Associate Editor*
J J O'CONNOR *Assistant Editor*
C F SANDERS *Assistant Editor*
C F MARSCHALEK *Art Editor*
SHELTON FISHER *Publisher*
W J HARING *Sales Manager*
Washington: GEORGE B BRYANT JR *Atlanta:* EARLE MAULDIN
WORLD NEWS OFFICES: *London, Paris, Frankfurt, Tokyo, Melbourne, Rio de Janeiro, Mexico City*

CROSS-INDEX OF SUBJECTS FOR THE MONTH

MAY 1950 • VOL 94 • NO. 5

PLANT OPERATING METHODS, MAINTENANCE AND SAFETY
STEAM GENERATION, FUELS, FIRING AND COMBUSTION
TURBINES, ENGINES, AUXILIARIES; HYDRO POWER
DIESELS, GAS ENGINES AND ACCESSORIES
AIR CONDITIONING AND REFRIGERATION
ELECTRICAL EQUIPMENT, ELEVATORS
PIPING, VALVES AND SPECIALTIES
TRANSMISSION, LUBRICATION
STEAM SERVICES, HEATING
INSTRUMENTS, CONTROLS
PUMPS, COMPRESSORS

FEATURE ARTICLES

		PLANT OPERATING METHODS, MAINTENANCE AND SAFETY	STEAM GENERATION, FUELS, FIRING AND COMBUSTION	TURBINES, ENGINES, AUXILIARIES; HYDRO POWER	DIESELS, GAS ENGINES AND ACCESSORIES	AIR CONDITIONING AND REFRIGERATION	ELECTRICAL EQUIPMENT, ELEVATORS	PIPING, VALVES AND SPECIALTIES	TRANSMISSION, LUBRICATION	STEAM SERVICES, HEATING	INSTRUMENTS, CONTROLS	PUMPS, COMPRESSORS
Macy's installs 5000 kilowatts of mercury-arc ignitron rectifiers	76		◀		◀	◀						◀
First coal-burning gas turbine piles up hours	80	◀						◀	◀			
Answers to your questions on hydraulic ash handling	83	◀			◀				◀	◀		
Are your motors overheating?	87					◀						◀
Putting water hammer under control	90	◀		◀	◀		◀	◀				◀
Mechanical vibrations: Cause and control — 1	92	◀	◀		◀		◀	◀	◀			◀
Split air-conditioning system raises textile plant's profits	94		◀	◀	◀		◀					◀
Insulation handbook: 3 — Which thickness pays best?	98			◀	◀							◀
New diesel delivers more power in same space	100							◀				◀
Tools for saving cooling water — tower types and uses	102						◀		◀			
What about the hydrogen bomb?	107									◀		
Letters from a turbine specialist — 7	111		◀		◀				◀			
Early planning provides water for boiler washing, startup	112		◀		◀					◀		◀
Making lubrication hazard-free	116			◀								◀
How power services work for auto maker	117	◀	◀	◀	◀		◀		◀	◀		◀
Power rake cleans pump's trash racks	121	◀						◀				

DEPARTMENTS

		PLANT OPERATING METHODS, MAINTENANCE AND SAFETY	STEAM GENERATION, FUELS, FIRING AND COMBUSTION	TURBINES, ENGINES, AUXILIARIES; HYDRO POWER	DIESELS, GAS ENGINES AND ACCESSORIES	AIR CONDITIONING AND REFRIGERATION	ELECTRICAL EQUIPMENT, ELEVATORS	PIPING, VALVES AND SPECIALTIES	TRANSMISSION, LUBRICATION	STEAM SERVICES, HEATING	INSTRUMENTS, CONTROLS	PUMPS, COMPRESSORS
Electronics: 25 — Smoke-density indicators: Part I	122	◀	◀	◀	◀	◀	◀	◀	◀	◀	◀	◀
Power engineer's notebook of plant-tested ideas	126	◀	◀	◀	◀	◀	◀	◀	◀	◀	◀	◀
Problems fresh from the plant	130	◀	◀	◀	◀	◀	◀	◀	◀	◀	◀	◀
Technical briefs for busy power men	134	◀	◀	◀	◀	◀	◀	◀	◀	◀	◀	◀
News of the power field	138	◀	◀	◀	◀	◀	◀	◀	◀	◀	◀	◀
Data sheet	142	◀	◀	◀	◀	◀	◀	◀	◀	◀	◀	◀
Plant-equipment news	144	◀	◀	◀	◀	◀	◀	◀	◀	◀	◀	◀
Engineer's bookshelf	154	◀	◀	◀	◀	◀	◀	◀	◀	◀	◀	◀
George Edwards	156	◀	◀	◀	◀	◀	◀	◀	◀	◀	◀	◀
Readers' service page	192a	◀	◀	◀	◀	◀	◀	◀	◀	◀	◀	◀

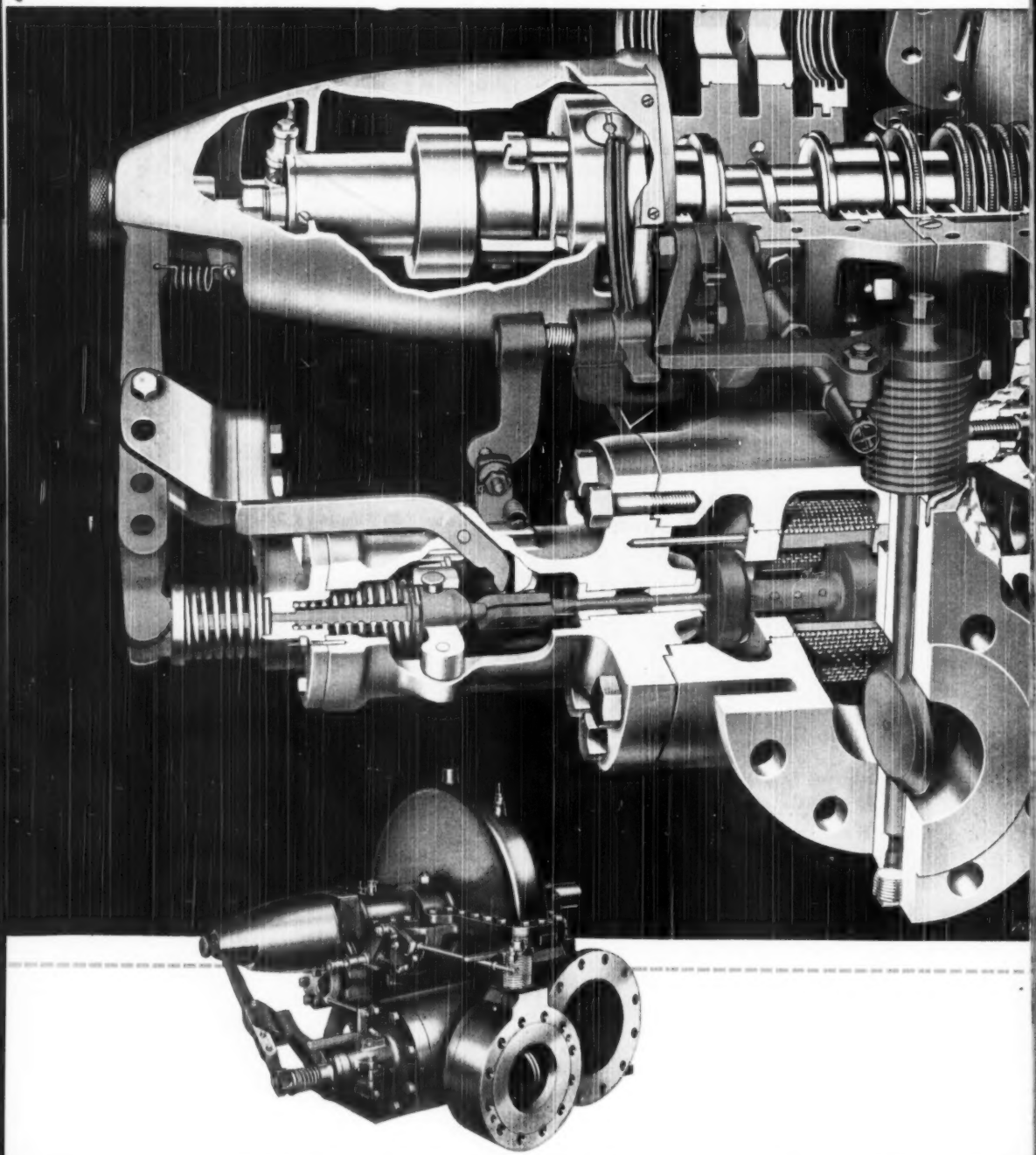
Cover photo taken in feed-pump area of recently expanded boiler house at Cities Service Co's East Chicago refinery. Courtesy of M W Kellogg Co, who handled the refinery modernization, including new boiler and renovation of feedwater system

VOLUME 94, NUMBER 5 • ABC • ABP • COPYRIGHT 1950 by McGRAW-HILL PUBLISHING CO., INC. • ALL RIGHTS RESERVED

James H McGraw (1860-1948), Founder; Curtis W. McGraw, President; Willard Chevalier, Executive Vice-President; Joseph A Gerardi, Secretary and Treasurer; Paul Montgomery, Senior Vice-President, Publications Division; Nelson Bond, Vice-President and Director of Advertising; J E Blackburn Jr, Vice-President and Director of Circulation • DISTRICT MANAGERS: New York, W W Quarles; Philadelphia, C R Long; Cleveland, N O Wynkoop Jr; Chicago, C Boughton, J L King; Boston, J E Slater; St. Louis, C Boughton • PUBLICATION OFFICE 418 West 25th St, New York 1, N. Y. • EDITORIAL AND EXECUTIVE OFFICE, 330 W 42nd St, New York 18 N Y • Cable Address: "McGraw-Hill New York • DISTRICT OFFICES: 520 N. Michigan Ave., CHICAGO 11; 8 Post St, San Francisco; National Press Bldg, Washington 4; Architects Bldg, Philadelphia 3; 738-9 Oliver Bldg, Pittsburgh 22; 1510 Hanna Bldg, Cleveland 15; 2980 Penobscot Bldg, Detroit 26; Continental Bldg, St. Louis 8; 1427 Statler Bldg, Boston 16; 1011 Rhodes-Haverty Bldg, Atlanta 3; Pacific Finance Bldg, Los Angeles 14; Aldwych House, Aldwych London WC2 • POWER articles are indexed in both the Industrial Arts and the Engineering Index • POWER issues its own index annually; copies are available on request to the editorial offices, 330 W 42nd St, New York 18.

YOU CAN BE **SURE**.. IF IT'S

Westinghouse



It's DOUBLE safe!

With Type E turbines, you can be sure of protection against overspeed. You can be doubly sure.

A sensitive, powerful centrifugal-weight governor provides extremely accurate speed control. Both the governor and its linkage connection are enclosed in a strong, specially-shaped housing to protect them from damage.

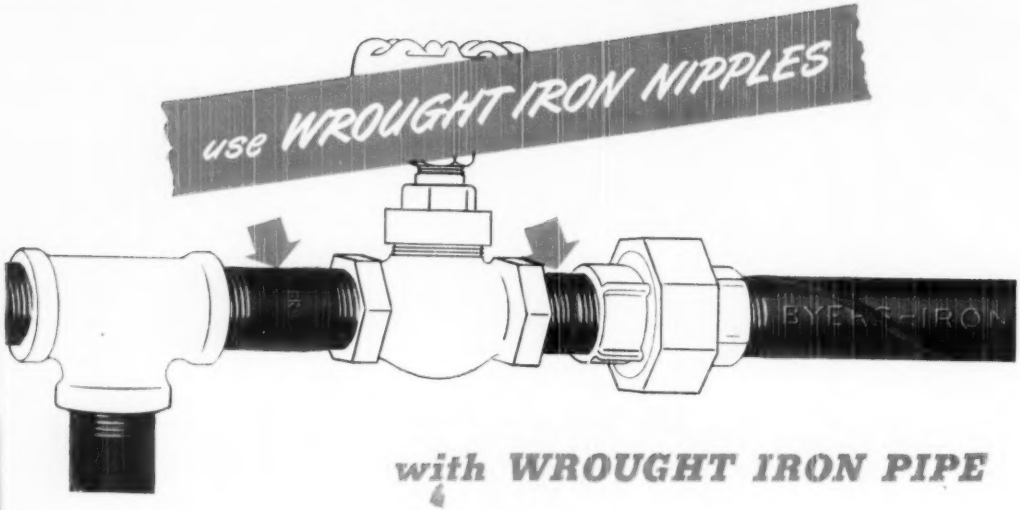
However, if for any reason the governor loses control, Type E *dual* protection takes over. A corrosion-resistant, spring-restrained weight, mounted in the governor hub, strikes a trip linkage . . . instantly closes the governor valve and an independent steam inlet butterfly valve. Steam is cut off positively . . . danger and resulting damage of overspeed are avoided.

Dual protection is but one of the significant features of Type E turbines. Wrapped up in one standard unit are the best features of previous Westinghouse mechanical drives, plus important refinements and new developments that add up to economical, dependable service under all operating conditions.

We invite your comparison . . . on *any* count. Get the facts from your nearby Westinghouse office, or write for 20-page book B-3896. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-50409

Westinghouse
TYPE E
Turbines

Avoid "Weak Links" in your piping systems—



with WROUGHT IRON PIPE

When you specify wrought iron pipe to lick some corrosion problem, assure 100% protection by specifying that the pipe nipples also must be wrought iron. Neglect of this simple precaution will leave weak spots in your lines, and set the stage for maintenance headaches.

METHOD OF SPECIFICATION

Merely stating that the piping "system" is to be black or galvanized wrought iron is not enough; the use of wrought iron nipples should be specifically designated. This may be done by requiring that the wrought iron nipples shall be made of pipe conforming to the requirements of A.S.T.M. Specification A72-45, Federal Specification WW-P-441a, Navy Specification 44P11k, or any accredited proprietary specification.

WIDE RANGE OF SIZES

Byers Wrought Iron nipples, both standard weight and extra strong, are available in a wide range of sizes and lengths, either black or galvanized. They are manufactured from new, tested, full-weight wrought iron pipe in accordance with the standards established in the specifications of leading technical organizations. All nipples are furnished with right-hand threads unless otherwise specified; nipples with right and left-hand threads are also available. Nipples are furnished "close" or to length as specified.

IDENTIFICATION

The word "Byers" and the weight —either "Std." or "X Stg." are machine stamped around the circumference of Byers Wrought Iron nipples. On close nipples, where it is impractical to stamp on the threads, a red band is used. These markings provide quick, positive identification of Byers Wrought Iron nipples, and help to avoid any danger of accidental substitution of non-durable nipples in the line.

IN WELDED SYSTEMS USE WROUGHT IRON WELDING FITTINGS

Wrought iron welding fittings are available in a wide range of types and sizes from leading fitting manufacturers. Just contact your supplier.

Wrought iron nipples are also available from a number of manufacturers. The identification used on such nipples may be learned by consulting the supplier.

INHERENT CORROSION RESISTANCE

The superior resistance of wrought iron nipples comes from the unique composition and structure of the material. Tiny threads of glass-like silicate slag, distributed through the body of high-purity iron, halt and "detour" corrosive attack, and so discourage pitting. The fibers also anchor the initial protective scale, which shields the underlying metal.

The best guide in applying wrought iron is a knowledge of its character and properties. The complete story is presented in the booklet, "The ABC's of Wrought Iron". Ask for a copy.

A. M. Byers Co., Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, Salt Lake City, Seattle, San Francisco. Export Division: New York, N.Y.

CORROSION COSTS YOU MORE THAN WROUGHT IRON

BYERS
GENUINE WROUGHT IRON
TUBULAR AND HOT ROLLED PRODUCTS
ELECTRIC FURNACE QUALITY ALLOY AND STAINLESS STEEL PRODUCTS

POWER

PHILIP W SWAIN, EDITOR • MAY 1950 • ESTABLISHED IN 1882

What About the H-Bomb?

AFTER WITNESSING the immensely impressive Bikini atom-bomb tests in 1946, I predicted that the uranium-plutonium bomb would gradually drift off the front pages of the newspapers, and then, after a few years, would come right up front again, when people began to suspect that Russia "had the bomb." That's what happened.

Public interest may follow the same course with the so-called "hydrogen bomb." Right now we are still in the phase of initial shock generated by the President's announced decision to make such a bomb, if possible. If this public excitement dies down somewhat, as it may in time, it will likely rise again later to plague the minds of men, for competent authorities say that H-bombs of immense power, and not too immense cost, can probably be built.

Because most power engineers are pretty vague about the whole business, we suggest that they read the two illuminating articles in the March and April issues of *Scientific American*. The authors are Dean Louis N Ridenour of Illinois, and Professor Hans Bethe of Cornell, both distinguished physicists.

The substance of Dean Ridenour's comments, in condensed form, appear on page 107 of this issue of POWER. Here are a few points to remember:

Present-day atom bombs work only by *fission*, that is by the splitting of heavy atoms in a chain reaction that starts automatically when the mechanism of the bomb quickly assembles plutonium or uranium 235 in greater than "critical" quantity. That's why a fission bomb can't be small; an undersized fission bomb simply won't explode.

At the upper limit a fission bomb can't be many times more powerful than the Hiroshima model.

The situation is very different with the contemplated *fusion* bomb, which has no known upper limit of power. Instead of splitting heavy atoms, the fusion bomb combines very light atoms into heavier ones. Ridenour suggests that the explosive material might be the rare isotopes of hydrogen, which (in the explosion) would combine to form helium and release immense reserves of energy.

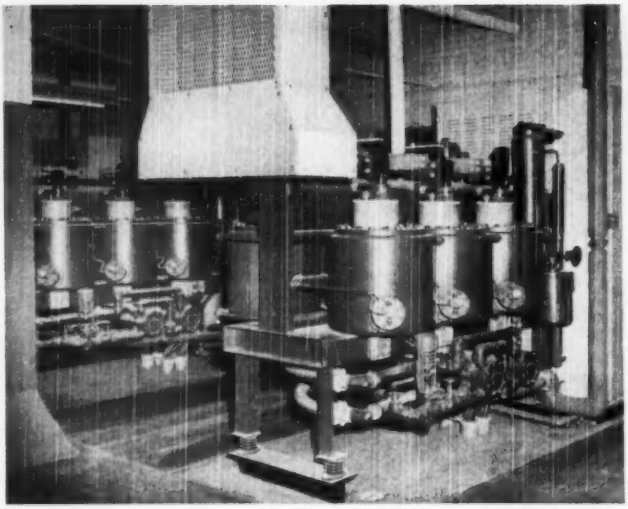
It takes millions of degrees to start this reaction, so the only conceivable detonator would be a complete fission bomb, powered with a full charge of U235 or plutonium. This core bomb would be surrounded by substances containing suitable hydrogen isotopes.

Competent physicists seem to agree that such a bomb could be made 10, 100 or even 1000 times as powerful as a Hiroshima-type bomb. A single fusion bomb of the largest size mentioned could utterly destroy any one of the world's greatest cities.

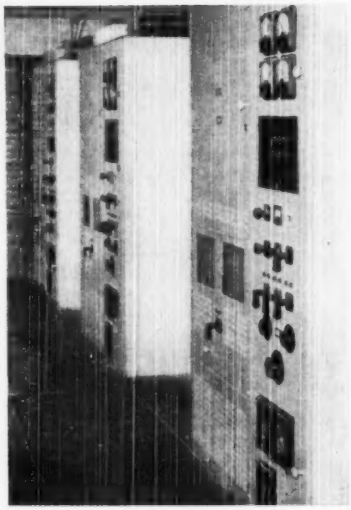
Despite the frightful possibilities, the President had no other course than to proceed with the attempt to produce this superbomb. Yet possession of this monstrous weapon (if and when we get it) cannot give us true security. In time, the other fellow will have one, too. And don't forget that the big American industrial cities are the world's most perfect targets for such bombs.

It seems that the time is coming soon when men must do something about war itself—or else. What can that something be? To get the answer you must consult authorities wiser than the editors of POWER. About all our puny minds can suggest at this crisis in world history is that engineers open their eyes to the nature and capacities of this sinister atom welder and that they then devote more thought to the practical problems of international relations in an atomic age.

PHIL SWAIN



1 Two of three 1500-kw 6-tank mercury-arc rectifiers. Connections to rectifier anodes are ½x4-in. copper bars run overhead enclosed as at top center



2 Control, metering and voltage-regulating panels for three rectifiers of 1500 kw each

Macy's Installs 5000 Kilowatts of

To meet rising power loads and costs, R H Macy replaced its 45-year-old steam plant with purchased steam and power. One of the largest 250-v mercury-arc rectifier installations supplies the dc load, and 3000-kw ac the fluorescent lighting

► R H MACY'S DEPARTMENT STORE, which occupies an entire block at Broadway and 34th St in New York, has 2,041,335 square feet of floor area. Until recently this home of the world's largest retail store had one of the most interesting power plants to be found anywhere. Not only was it the largest privately owned power plant in the city, but the largest of its kind ever built.

Steam and Diesel Plant. Its primary power units included 3350 kw in steam engines, a 1000-kw mixed-pressure condensing turbine, and three 700-kw diesel engines—a total of 6450 kw, driving 230-v dc generators. Steam was supplied by eleven oil-fired boilers, with 30,000 sq ft of steam-making surface. In addition, the plant includes a large air-conditioning installation, a refrigerating plant, cash-distribution-system blowers, pumps and other equipment. Connected load amounted to over 12,000 kw, with daily peaks over 6000 kw. Power load includes over 800 motors, ranging from fractional to 150 hp, 70 escalators and 54 elevators.

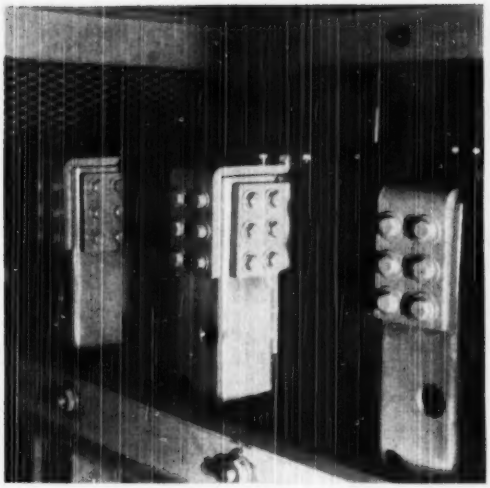
Compared to purchasing power and steam, the power-generating plant operated at a large saving up to a few years ago. But it was then found advisable to change to purchased power and steam. Now a large part of the lighting load is supplied by ac, and the power load by 5000 kw of mercury-arc rectifiers. This is the largest installation of its kind in the world that supplies a building load.

Load Increases. Because of adding to air-conditioning capacity, illumination and other power uses, Macy's power load has always been on the increase. By 1938, it was evident that a large addition to power capacity would be required to supply future load and provide a safe operating reserve. So Kaiser, Muller & Davies, consulting engineers, were retained to restudy the power supply and make recommendations.

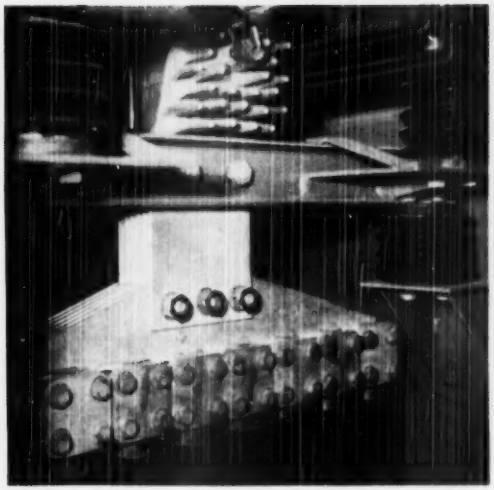
Several steam engines and most of the boilers were 35 years old, operating at 150 psi saturated. Also, space was not available to increase plant size. These problems could have been solved by designing an entirely new steam plant, to be installed in the space occupied by the old one, using 450-psi boilers and condensing turbines. When designs were completed, this plant's installation could have been justified economically, but the war started and further consideration was held until 1946.

In the meantime, equipment, material and construction costs had greatly increased, fuel prices had skyrocketed and its delivery had become uncertain, and labor cost had substantially increased. These factors made it practically uneconomical to rebuild the plant. Furthermore, the space occupied by the old plant could be used for storing and handling merchandise.

Changeover. Added to these conditions, the lighting-system feeders and circuits were nearly 45 years old and overloaded. So it was decided to replace most of the feeders in the store and install a modern fluorescent-lighting



3 Right-angle connection in 5-in.-square ½-in.-thick copper tubes between the ac bus and 6000-ampere circuit breaker



4 This massive copper terminal connects fifteen 750,000-cm cables from the cathode bus to 8000-amp dc circuit breaker

Mercury-Arc Ignitron Rectifiers

system. Instead of decreasing the load, this change increased it because of increased illumination intensity. The load required alternating current, which the old dc plant could not supply. So power was purchased for it, which now amounts to about 3000 kw.

Next step in the changeover was to purchase all steam for operating the steam power units and shut down the old boiler plant. Removal of the boilers provided space for installing 5000 kw of General Electric mercury-arc rectifiers in three 1500-kw units and a 500-kw unit. Each rectifier has its own transformer and bus structure that connects it between the power company's bus and the main dc bus.

Power Connections. From the low-voltage ac bus in the power company's vault, connections are made to a 3-pole drawout-type 6000-amp ac circuit breaker with 100,000-amp interrupting capacity. These connections are made with 5-in.-square ½-in.-thick copper tubing run overhead in an enclosure, Fig. 5. Tubing reduces the skin effect of the large ac conductors. It also permits installation of rigid supports to withstand the large mechanical forces produced by the heavy currents that may develop during a fault.

Because of the short distance between rectifiers and the main transformers, careful study was given to keeping circuit reactance as high as possible without seriously affecting voltage regulation. To this end the tube conductors are supported 16 in., center to center, in insulator blocks held in steel frames. Tubes have holes in top and bottom sides for free circulation of ventilating air, Fig. 3. This photo shows a right-angle connection in one of the buses and gives an idea of its heavy, rigid construction.

Rectifier ac circuit breaker and transformer are installed in the same cubicle. Transformer is connected delta on the primary, and double-wye on the secondary, with an interphase transformer between wyes, Fig. 6. The six anode connections are each a ½x4-in. flat copper bar, run overhead in an enclosure. All six cathode terminals connect to a common bus below each rectifier bank. From this bus, 15 insulated 750,000-cm cables run to the bottom terminal of an 8000-amp dc solenoid-operated circuit breaker, Fig. 4. The 15 cables are arranged in five groups of three and run under the floor in 3½-in. conduit. Top terminal of the circuit breaker connects through a disconnect switch to the main bus.

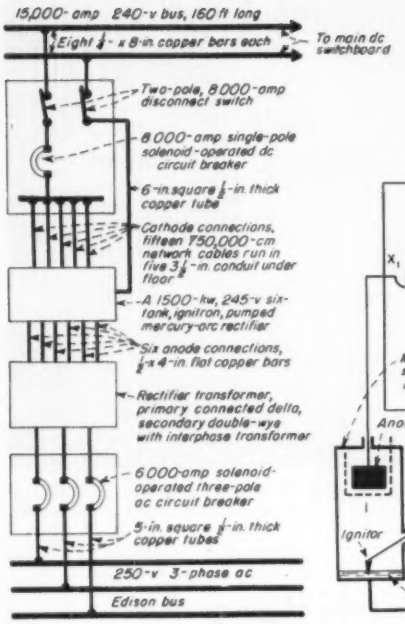
Center tap on the interphase transformer connects by a 6-in.-square ½-in.-thick copper tube, run overhead to a disconnect switch in the dc circuit-breaker cubicle. This switch also connects direct to the main bus.

Connections for the 500-kw rectifier are the same as for the three 1500-kw units, but have lighter conductors for the smaller load. The three large rectifiers can supply the day load and have ample reserve capacity. After the store closes, one large rectifier and the small one meet demands under most conditions. At certain times during off-peaks the small unit does the job.

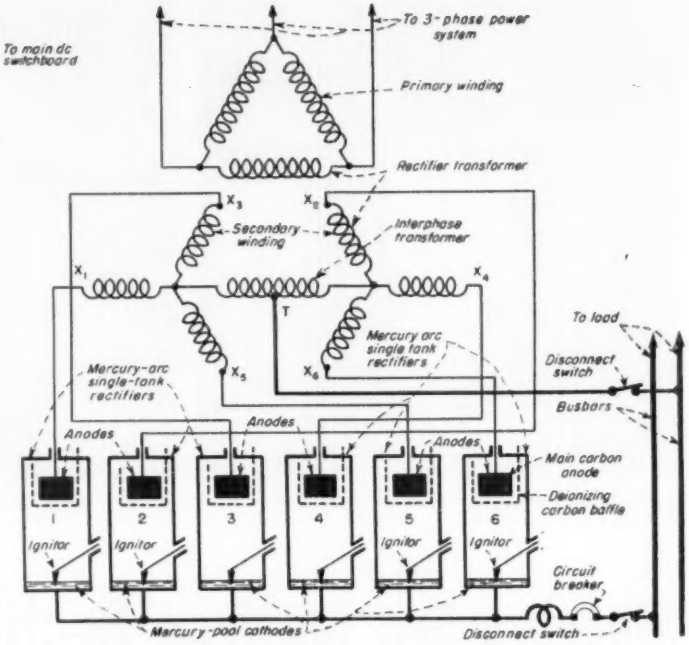
Rectifiers in Parallel. All four rectifiers can operate in parallel and divide the load automatically in proportion to their capacity. Once the desired voltage is set it is held at that value automatically.

Main bus from the rectifiers runs overhead 160 ft to the main switchboard. Each bus leg has eight copper bars, 8 in. wide, ¼ in. thick. This long bus was necessary to have the rectifier station in space occupied by the boiler plant. Main switchboard could have been moved near the rectifiers. But this would have required extending all power circuits—a change that would have cost more than the long bus.

Power panels of the old switchboard are retained, and all dc power circuits stay as they were before the changeover. Most of the old dc lighting panels have


15,000-amp 240-v bus, 160 ft long
Eight ¼- x 8-in. copper bars each
To main dc switchboard
Two-pole, 8000-amp disconnect switch
8000-amp single-pole solenoid-operated dc circuit breaker
6-in. square ½-in. thick copper tube
Cathode connections, fifteen 750,000-cm network cables run in five 3½-in. conduit under floor
A 1500-kw, 245-v six-tank, ignitron, pumped mercury-arc rectifier
Six anode connections, ¼- x 4-in. flat copper bars
Rectifier transformer, primary connected delta, secondary double-wye with interphase transformer
6000-amp solenoid-operated three-pole ac circuit breaker
5-in. square ½-in. thick copper tubes
250-v 3-phase ac
Edison bus

5 Diagram shows the connections from alternating-current to the direct-current service bus, also how they are made



6 Transformer and rectifier connections. Transformer is connected delta on the primary, and double-wye on secondary

been removed, a large part of this load having been put on the ac system.

Two Rectifier Types. Mercury-arc rectifiers are two types—continuously pumped and sealed ignitron. In the former, a high vacuum is maintained by an automatically controlled vacuum pump, whereas, in the latter, proper vacuum is produced when the rectifier is built and sealed to maintain it.

Fig. 8 shows a cross section through a pumped-type ignitron mercury-arc rectifier. At its bottom is the mercury-pool cathode into which the ignitor tip dips. Tip is continuously immersed in the mercury pool. Supported on a flexible diaphragm at *D*, immersion of the ignitor in the mercury pool can be adjusted from outside the tank without disturbing the vacuum-tight joint.

Above the mercury pool is a graphite-disk splash baffle supported on three quartz insulators from the bottom of the vacuum chamber. This baffle prevents mercury splashing from the pool onto the anode, which might cause an arc-back from anode to cathode and short circuit the rectifier.

Main graphite anode is supported on a metal stem sealed by a special insulator in the vacuum-chamber cover. This anode is surrounded by a deionizing baffle that is also supported from the vacuum-chamber cover by special insulators. Baffle is thus insulated from the tank and may be energized by a conductor entering the chamber through a sealed-in insulator.

Normally this baffle creates suitable arc conditions for correct rectifier operation. During part of the operating cycle, the baffle is made positive to help start anode conduction. At other times, it is negative to shield the anode from ionization that persists in the arc path during the inverse wave.

Around the anode terminal outside the vacuum chamber is the anode heater that automatically maintains the anode assembly temperature above that of the water jacket. This temperature differential, particularly at light loads, prevents mercury vapor condensing on the anode, and causing arc-backs.

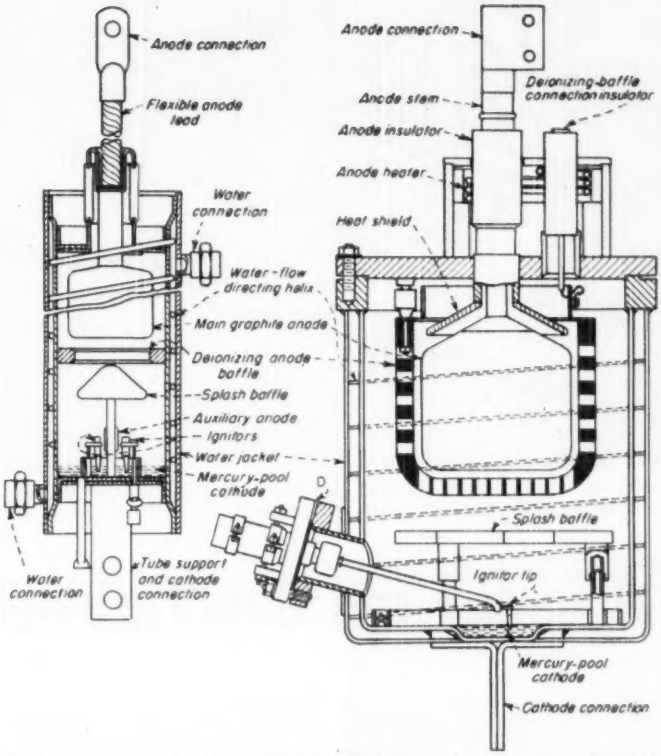
In Fig. 8, the tank in which the rectifier parts are assembled consists of a top flange to which are welded the vacuum chamber and water jackets. Cooling water enters near the tank bottom and is directed upward by a spiral spacer strip that causes the coolant to flow spirally around the tank in a narrow stream to produce uniform cooling.

At the tank bottom the heavy-cathode connection is brazed to the underside of the mercury-pool container. At the top of the anode's stem is the heavy anode connection.

Rectifier Operation. In this type rectifier the mercury vapor is ionized during the conducting half of the cycle only. Conduction is started by the ignitor in the mercury pool. When the rectifier is to conduct, the controller causes current to flow from the mercury pool to the ignitor. Made of boron-carbide, the ignitor has a high resistance and is in intimate contact with the mercury, which has low resistance. Current flowing through the ignitor causes high temperature between its surface and mercury to form a cathode spot (arcing) on the surface of the mercury. This spot releases the necessary electrons to the anode and the rectifier conducts during the half cycle. At the end of the cycle the mercury vapor is deionized, and the rectifier ceases to conduct until the ignitor starts it again.

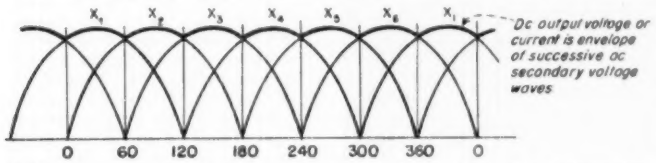
Means are provided in the control to delay energizing the ignitor. So the rectifier starts to conduct later than the beginning of the half cycle. By doing this the average output voltage can be held constant under all load conditions.

Each rectifier has six tanks connected to a 3-phase transformer with its windings grouped delta on the primary and double-wye on the second-



7 Cross section of sealed mercury-arc rectifier like the Macy 500-kw unit

8 Cross section through continuously pumped ignitron mercury-arc rectifier


X_1 X_2 X_3 X_4 X_5 X_6 X_1
Dc output voltage or current is envelope of successive ac secondary voltage waves
0 60 120 180 240 300 360 0

9 Direct-current output voltage and current is the envelope of the alternating-current secondary waves that are shown by the heavy curved line in the diagram

ary with an interphase transformer, Fig. 6. We can assume that current flows from center tap T on the interphase transformer through the load, up through tank No. 1 to transformer terminal X_1. One-sixth of a cycle later, current flows from center tap T, through the load and tank No. 2 to transformer terminal X_2. One-sixth of a cycle later, No. 3 tank conducts, and so on to tank No. 6.

As a result, six current impulses are supplied to the load during each cycle so the dc output of the rectifier looks like the heavy curve Fig. 9. This curve is made smoother by the action of the interphase winding and will also have its form changed by the voltage-regulating system.

Sealed Rectifier. This type, Fig. 7, is similar in construction to the pumped design, except the former is sealed to maintain its vacuum. It has two ignitors so if one fails the other is available without opening the rectifier. This unit also has an auxiliary graphite anode above the mercury pool. After the ignitor creates the cathode spot, the auxiliary anode maintains it during the remainder of the conducting period while the main anode fires. This insures sufficient ionization of the mercury vapor to permit the main anode to carry the load current. It also relieves the ignitor of all work but starting the rectifier.

Elements are sealed in a stainless-steel water-jacketed vacuum chamber. The graphite deionizing baffle instead of being around the main anode, as in Fig. 8, is a ring below it. But the connections, operation and control of the two rectifiers are practically the same.

Rectifiers at Macy's form one of the largest 250-v installations that have been made. Going into operation eight months ago, they have operated without any trouble. Each day the rectifiers are switched on and off the system to meet load demands, which vary from 12,000 to 500 amp.

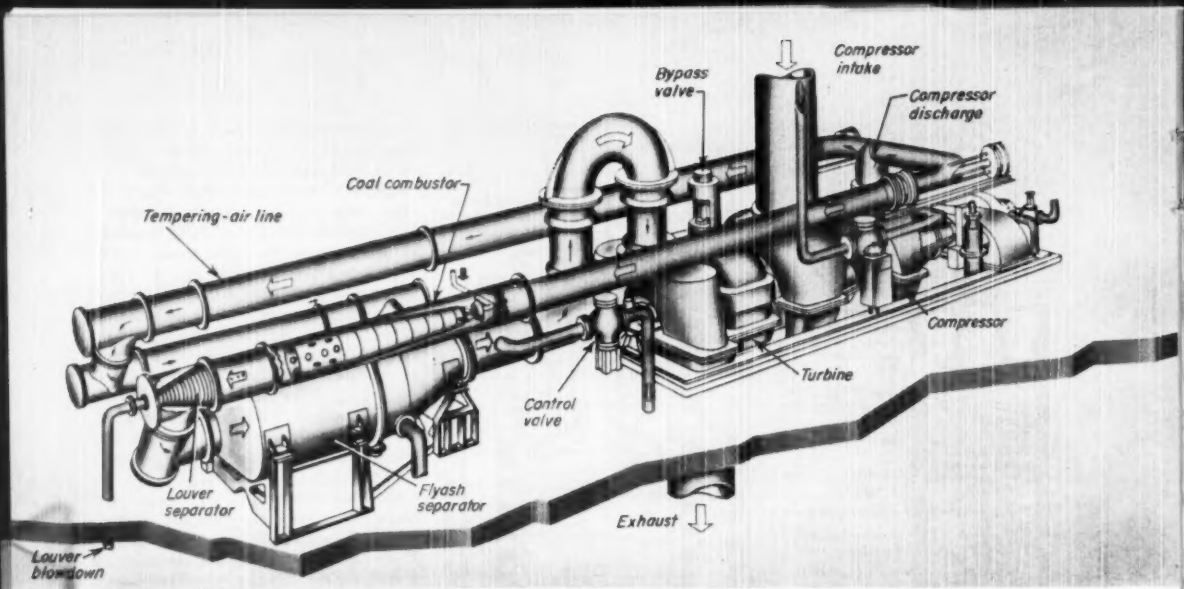
On this project, Kaiser, Muller & Davies, consulting engineers, did all the electrical engineering. Voorhees, Walker Foley & Smith were the architects. Meyer, Strong & Jones, consulting engineers, did all heating, ventilating and mechanical design work. General contractor was Vermilya-Brown Co, and electrical contractor was Albin Gustafson Co. All electrical equipment, transformers, circuit breakers, rectifiers and controls were supplied by General Electric Co. Macy's representatives, administering the project, were R G Belcher, architect, D J Creeden, chief engineer, and H A Giese, construction superintendent.

HOW TO CONTROL DISCHARGE OF PUMPS

Discharge of power-driven reciprocating pumps cannot be controlled by throttling.

With this type pump, when adjustable discharge is needed, use an adjustable-speed or a constant-speed motor with variable-speed transmission. On ac power lines a wound-rotor or commutator-type polyphase motor gives necessary speed adjustment. With dc power, you can use a shunt motor. The same recommendations apply to centrifugal pumps when it is desirable to vary discharge by speed control.

It is often more economical to drive the pump at constant speed and adjust its discharge by throttling. For adjustable speed, hydraulic or magnetic couplings are often used.



FULL-SCALE TEST PLANT has discharge from compressor (far right) divided. One line (foreground) contains coal combustor and flyash separator. Other, called tempering-air line, has oil combustor. Flow from two lines joins at separator outlet

Experimental Coal-Fired Gas Turbine

Inspection after more than 250 hr reveals no signs of trouble in full-scale test plant. J I Yellott reports on equipment layout, testing program, future activity

► EARLY IN 1945, officials of six major Eastern railroads and three large coal companies faced up to a tough decision. Was there a chance to develop a vastly better coal-burning locomotive? They decided there was, and backed their verdict with hard dollars. In association with Bituminous Coal Research they formed the Locomotive Development Committee*, picked John Yellott to head its research program.

Fixing early the direction of attack, they pinned their faith on the gas turbine. For their daring they had promise of great rewards—and assurance they were tackling the toughest string of engineering problems to come down the pike in a long time. How to keep ash from scouring away turbine-blade surfaces? How to burn pulverized coal under pressure at rates many times higher than normal? How to feed and pressurize the coal? And not least, how to do the whole job in the snug confines of a working locomotive?

Small-Scale Tests. There was only one way to go at it—make simultaneous attacks on the problems of coal handling, combustion and ash removal, try out promising ideas on a small-scale basis. For close to four years, engineers in various research centers struggled with assignments set for them by the Committee (see table on p 82). Many promising paths turned into blind alleys, some ideas paid off.

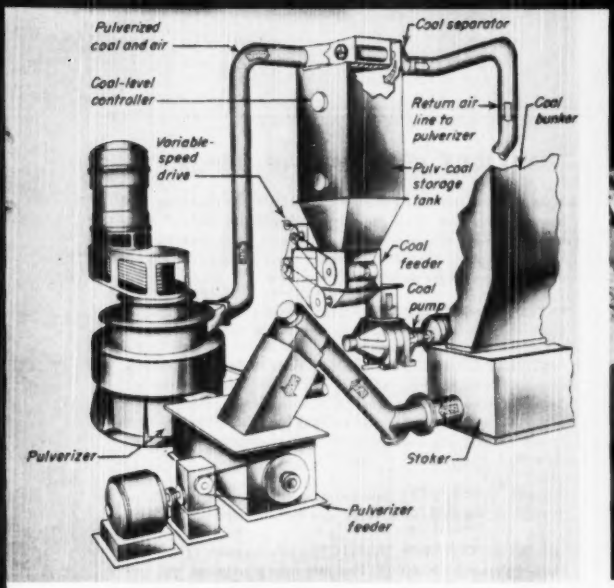
Last month at the Midwest Power Conference, John Yellott told interested engineers what they'd been waiting to hear—a full-scale test plant had burned coal for some 250 hr. True, he said, that's a short period, and turbine temperature was lower than will be used in the locomotive. Final verdict must wait on thousands of hours of testing at full temperature. But experience to date indicates that at least partial solutions have been found for the basic problems of coal preparation, combustion and ash removal.

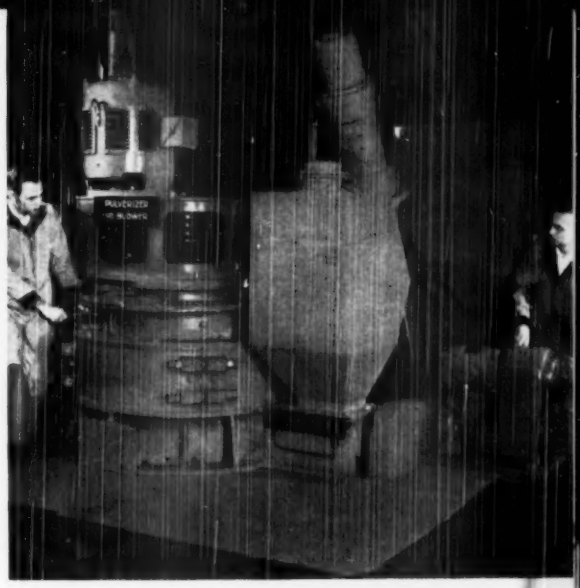
Present full-scale test program got under way when a Houdry-process gas-turbine plant, originally destined for a Russian oil refinery, was made available to the Committee by the U. S. Bureau of Mines. After study of possible hookups, scheme shown above was adopted and erection began in May 1949, at the Dunkirk plant of Alco Products Division, American Locomotive Co.

Test Layout. Compressor of Houdry unit takes in atmospheric air through a metering section and silencer. Compressor discharge divides into two lines. One (foreground in picture) contains the coal-combustion system and flyash separators. The other contains an oil-burning system. Thus unit starts on oil, transfers to coal.

To simulate performance of one of the twin combustors to be used with the actual 4200-hp locomotive turbine, compressor air flow can be divided so approximately 93,000 lb of air per hr pass through coal side. Remaining 113,000 lb flow through oil side. An oil-fired air preheater in the coal side raises temperature ahead of combustor. This will be done by the regenerator in the actual locomotive unit. Made of stainless steel, coal-burning and ash-removal equipment can operate safely at 1300 F. But Houdry turbine is limited to a temperature of 1000 F. so air coming through oil side of system is used for tempering. It joins 1300-F gas from coal combustor at the flyash separator outlet, reduces gas temperature to a value safe for the turbine.

*Membership now includes nine major Eastern railroads, five leading coal producers





COAL-PREPARATION SYSTEM has bunker (right) from which a stoker screw moves coal to feeder and pulverizer. Powdered coal goes through separator and into storage tank. It is fed as needed into "coal pump" and pressurized for combustor

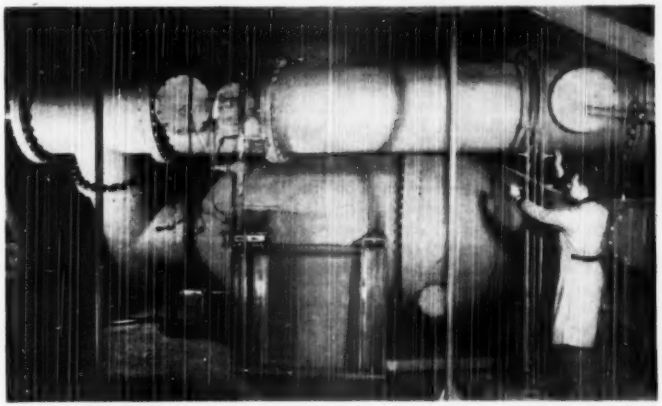
Piles Up Hours

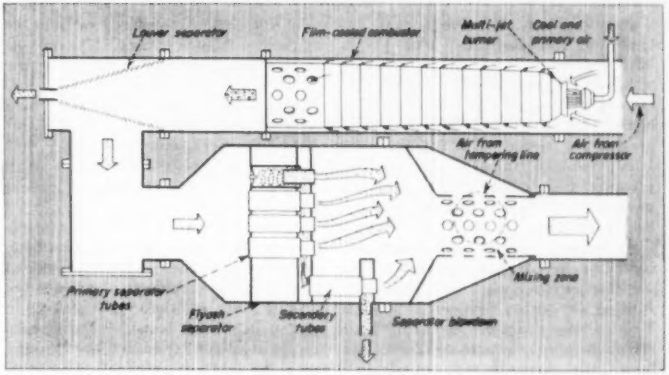
Oil-burning combustors resemble film-cooled units used in jet aircraft. Peabody wide-range burners give good atomization at low combustion rates. Spark igniters, equipped with fixed-orifice oil burners, are used in all combustors.

Coal Combustor. Test-plant coal combustor consists of telescoping cylindrical sections of stainless steel (⅛ in. thick) supported by external girders. Original riveted construction was replaced because ash deposits built up in wake of each rivet. Air enters at slots between rings, giving effective film cooling. Excess air mixes with products of combustion in last 30 in. of combustor length, entering through large holes (see diagram, right).

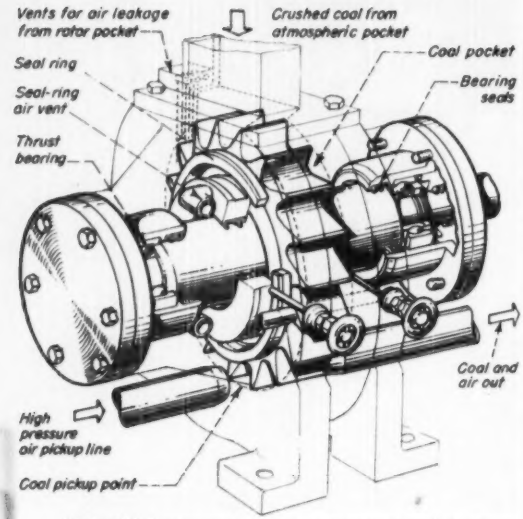
Burner represents a modification of multi-jet design originally used at Battelle Memorial Institute. With this device, combustion efficiency consistently exceeds 95%; burning rates have reached 1800 lb per hr. After a continuous test of 32 hours, combustor was clean and completely undistorted. Present work looks to improving combustor range so turbine can be operated on coal without need for oil pilot flame.

Ash Removal. A "louver" separator forms first stage of ash-removal equipment. Built by Turbodyne Corp engineers from data supplied by American Air Filter Co, it has stood up to several





COMBUSTOR, FLYASH SEPARATORS are arranged as shown in diagram, photo above. Louver separator is first ash-removal stage; battery of tubes completes the job



COAL-PUMP rotor pockets receive pulverized coal at atmospheric pressure and discharge below at higher pressure

SMALL-SCALE DEVELOPMENT OF COMPONENTS

JOHNS HOPKINS UNIVERSITY: Early tests of handling and burning equipment. Work to obtain fundamental data on coal-handling under pressure, air-jet pulverizing, heat loss through high-temperature flexible insulation, spontaneous combustion of coal stored under pressure, coal feeding

BATTELLE MEMORIAL INSTITUTE: Development and testing of combustors for atmospheric and pressurized firing

INSTITUTE OF GAS TECHNOLOGY: Tests to determine relation between dust content of high-velocity high-temperature air and erosion of turbine-blade materials. Investigation of attrition devices to improve performance of coal atomizer. Tests on use of long slow-speed screws for coal pressurizing. Studies of partial gasification of coal

PURDUE UNIVERSITY: Investigation of influence of sulphur dioxide on stainless steel under gas-turbine conditions

SOUTHERN RESEARCH INSTITUTE: Development of an air-balance device for measuring feed rate from pressurized coal tank

hundred hours of operation without visible harm. It takes out about 50% of solids in combustion products, and also serves to eliminate stratification of heated gas leaving combustor.

A battery of 18 American Blower type ST separators, shown on preceding page, handles final ash removal. Approximately 90% of the 20,000 cfm from the combustor passes directly through the tubes. Most of the remaining dust goes into the 10% of the gas that passes through secondary tubes. This dust is concentrated again into about 1% of the original air stream, which is then blown down through a small nozzle. Remaining 9%, carrying fine dust which is not removed in secondary collection system, can be readmitted to main gas stream on way to turbine.

Mixing Zone. Relatively cool gas from the oil-heater side joins gas at 1300 F from the coal side in a mixing zone, which resembles the cooling section at the end of the combustor. Designed by the Battelle combustion group, this scheme has worked well. It is possible to maintain whatever temperature the turbine needs for self-sustaining operation while coal-burning side discharges at 1300 F.

At a firing rate of 1800 lb per hr, combustor heat release runs about 750,000 Btu per hr per cu ft, or 6,000,000 Btu per hr per sq ft of cross section. Under these conditions combustor runs relatively cool and clean. There has been little slagging and virtually all ash appears as a fine, dry powder suspended in the combustion products. Building up of ash on combustor walls takes place only where air flow is interrupted by some protrusion, such as a rivet. Deposition appears to be an aerodynamic matter which is minimized by use of finely pulverized coal.

Coal Preparation. Coal for the test unit is provided by the system shown in diagram and photo on the preceding page. An Iron Fireman stoker under the bunker supplies coal in minus 2-in. lumps to a Whiting high-speed impact mill, which includes a fan and classifier. The fine coal, 97% through 100 mesh, flows upward with conveying air to a coal separator on top of the pulverized-coal storage tank. This separator is a combination of two American Blower type ST361 tubes and a louver. Cleaned air returns to the pulverizer. Vented air, always needed in a closed system like this, is the secondary flow from the American Blower tubes. Makeup air comes through an opening at pulverizer inlet.

Coal level in tank is controlled by a single Fuller rotary level indicator just below the coal separator. Stoker feed responds to a level control on a small hopper from which pulverizer feeder takes its supply.

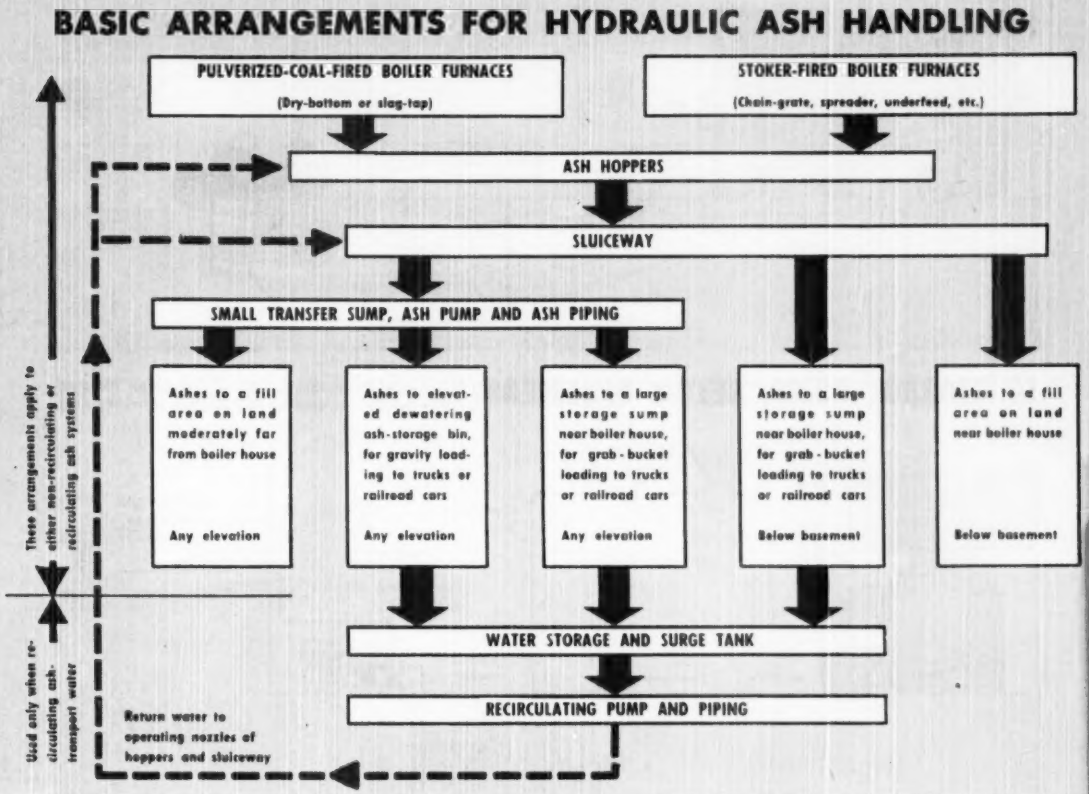
A variable-speed drum feeder controls rate of coal flow from tank. First tests of this setup showed that pulverized coal in storage tank was highly aerated and its bulk density ran as low as 20 lb per cu ft. Also, it is fluidized to such an extent that it will readily flow through even the smallest crevices. Some difficulty has been met from feeder leaks and this still gets vigorous study.

Coal Pump. Basic idea of the coal system is to keep preparation and feeding at the one pressure which remains constant in a gas-turbine system under varying loads—atmospheric pressure. The continuous pressurizing of the coal, at whatever rate may be established by the feeder, is handled by the rotary "coal pump" shown above. Two different types of coal pump have been tried extensively but it appears that the blow-through feature of the pump illustrated (developed by Turbodyne Corp engineers) is essential. Compressed air flowing in a 1¼-in. line carries pulverized coal from bottom of pump to combustor. Pump rotor merely transports coal from atmospheric-pressure zone to high-pressure zone. Throttle for over-all plant control is thus the variable-speed drive on the coal feeder. Pulsations that might be expected from operation of drum feeder and coal pump prove of no importance.

Test-Plant Operation. Dunkirk installation is not intended to produce power, hence has no generators. A small steam turbine, rigidly coupled to high-speed shaft of reduction gear, starts the unit. In a future application of this power plant it is expected that a 60-cycle alternator will be coupled to low-speed shaft of this gear.

Controlling amount of high-pressure air bled out, and amount of fuel supplied, regulates the plant. Unit is normally started by bringing it up to 2000 rpm on the steam turbine. Then oil burner in tempering line ignites and unit begins to accelerate. Preheater on

(*Continued on page* 200)


BASIC ARRANGEMENTS FOR HYDRAULIC ASH HANDLING
PULVERIZED-COAL-FIRED BOILER FURNACES
(Dry-bottom or slag-tap)
STOKER-FIRED BOILER FURNACES
(Chain-grate, spreader, underfeed, etc.)
ASH HOPPERS
SLUICEWAY
SMALL TRANSFER SUMP, ASH PUMP AND ASH PIPING
Ashes to a fill area on land moderately far from boiler house
Any elevation
Ashes to elevated dewatering ash-storage bin, for gravity loading to trucks or railroad cars
Any elevation
Ashes to a large storage sump near boiler house, for grab-bucket loading to trucks or railroad cars
Any elevation
Ashes to a large storage sump near boiler house, for grab-bucket loading to trucks or railroad cars
Below basement
Ashes to a fill area on land near boiler house
Below basement
These arrangements apply to either non-recirculating or recirculating ash systems
WATER STORAGE AND SURGE TANK
RECIRCULATING PUMP AND PIPING
Used only when recirculating ash-transport water
Return water to operating nozzles of hoppers and sluiceway

16 Answers to Your Questions on

HYDRAULIC ASH-HANDLING SYSTEMS

By H R PURSEL, *Manager, Hydraulic Ash-Handling Div, Beaumont Birch Co*

For high handling capacity, flexibility of layout, and variety of disposal schemes, take a look at modern high-pressure hydraulic systems. Here's what you need to know

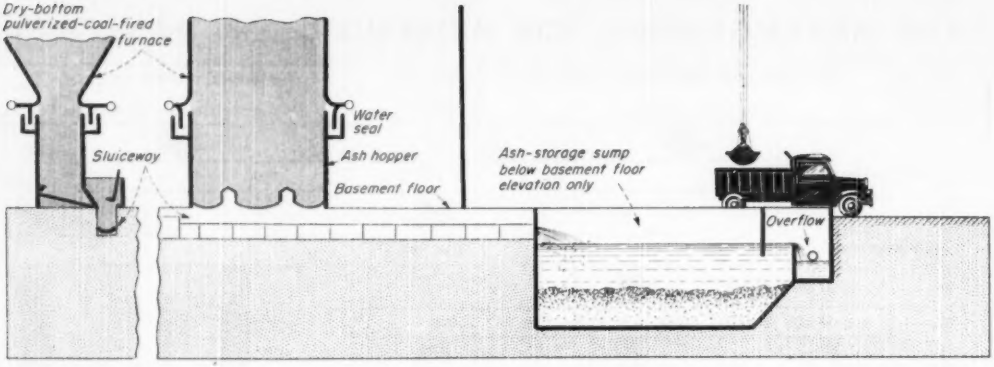
► WITH CONVEYING RATES on average ashes of about one ton per minute, modern high-pressure hydraulic ash-handling systems prove well suited to central stations and larger industrial plants. These systems are highly flexible, fitting any type of furnace, method of coal firing, arrangement of boilers. Furthermore, they permit a wide variety of disposal schemes.

1 What are the elements of a hydraulic ash-handling system?

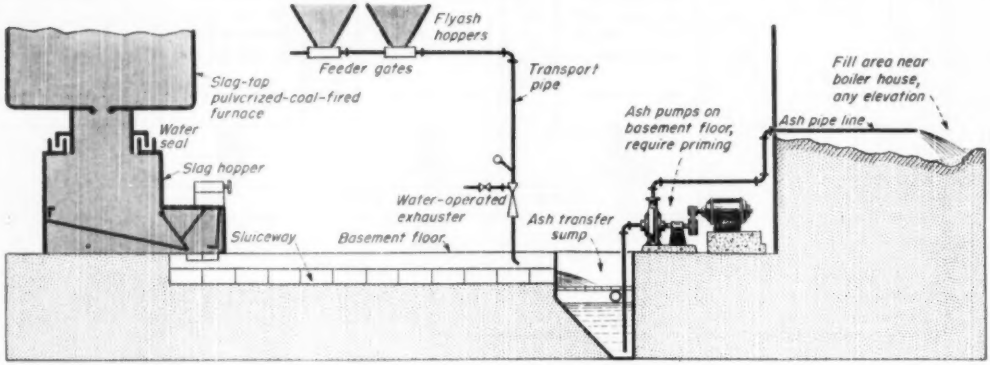
Ash hoppers continuously receive ashes or slag from the primary furnace and store them. Periodically, ashes are removed at high handling rates. High-velocity water serves as carrying medium for feeding ashes from hoppers to *sluiceway* and thence to point of disposal. Sluiceway may discharge ashes directly to *fill* or *storage*, or to a small *transfer sump* and then to point of disposal by way of an *ash-handling pump* and ash piping. See flow diagram above, typical layouts on next page.

2 What are the advantages of hydraulic ash handling?

The system is completely closed. No dust, water, ashes or gas escape to the boiler. Operators are not exposed to hazards of hot ashes. This method handles (1) wet or dry ashes (2) molten slag tapped continuously or intermittently (3) large lumps of any density. Intermittent operation provides large reserve capacity. By eliminating basement height needed for trucks, cars or



TO STORAGE SUMP, BELOW BASEMENT Sluiceway discharges by gravity to sump close to boiler house, for grab-bucket loading to trucks, cars



TO FILL AREA, ANY ELEVATION With transfer sump and ash pumps, ashes can be discharged to fill area moderately remote from boiler house and at any elevation

other handling equipment, building costs may be reduced.

3 What attention is needed for routine operation?

Under average conditions, one attendant handles the job. Usually, he starts water flowing, then controls discharge of ashes from the first hopper to the sluiceway, one section at a time. He repeats this operation until all hoppers are empty. Then he cuts off water flow and closes down the system until the next ash-handling time. Feeding ashes from hoppers to sluiceway is usually done with feed jets, under operator's view and control.

After ashes are in the sluiceway, rest of conveying (to elevated bin, fill area or storage sump) is entirely automatic and needs no attendance. High removal capacity permits all ashes piled up during a shift (or longer) to be sluiced away from each hopper feed section in a few minutes.

4 How about the auxiliary-power requirements?

Under conditions met by most hydraulic systems, power needs generally fall within these limits: sluice pump for delivering high-pressure water to sluiceway and hopper feed nozzzles, 75 to 250 hp; ash pump, 25 to 125 hp; ash crusher, 15 to 20 hp. These top figures may be exceeded for very long sluiceways, or if ash pump must elevate ashes through great vertical distances. Intermittent operation means power use only during short time ashes are being conveyed. Net result is low power cost relative to amount of material handled.

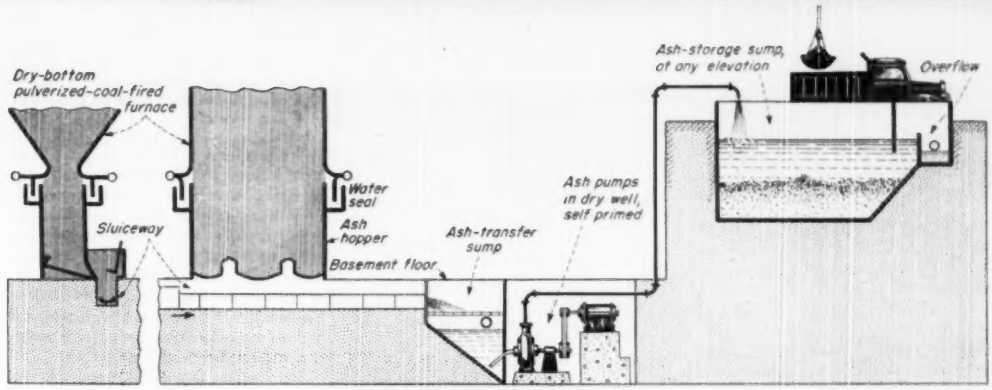
5 How does flyash and dust removal enter the picture?

Flyash and dust from secondary collection hoppers beneath economizers, air heaters, dust collectors, etc, and at stack bases, are generally handled in high-velocity air streams under partial vacuums. This makes a totally enclosed, dustless system. Dry dust may be wetted and discharged to the sluiceway for transport to point of disposal (see diagram above). Or, secondary-hopper flyash-handling system may be independent from primary ash-handling system except for common use of related auxiliary equipment. (A second article will deal with flyash handling.)

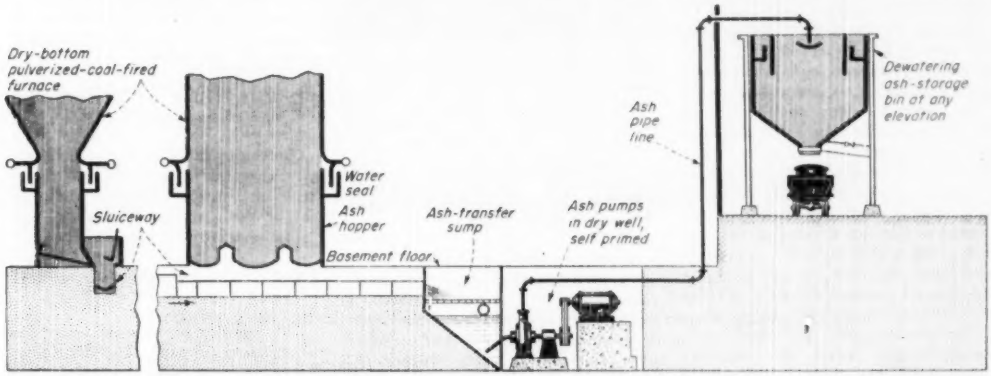
6 What kind of ash hopper serves a dry-bottom pulverized furnace?

Hopper consists of refractory-lined cast-iron or steel walls extending downward from furnace-ash-discharge opening. Hopper usually ends at basement-floor elevation with a refractory-lined bottom. Usual volume is enough to store ashes from 10 hr of maximum steam generation. Ashes then may be removed once per shift.

Low refractory crickets form one or more ash feed sections in the refractory bottom. Each section slopes slightly downward and ends at a feed door in the hopper wall.



TO STORAGE SUMP, ANY ELEVATION **Again, use of small transfer sump and ash pumps permits location of the storage sump at any convenient elevation**



TO DEWATERING BIN, ANY ELEVATION **Elevated dewatering-type storage bin, to which ash is pumped, permits gravity loading direct to trucks or cars**

Feed nozzles for directing water jets at bottom of ash pile are set at front of each feed section or at rear. Where large masses of heavy slag are expected, there are nozzles front and rear. While the attendant watches and controls operation, ash feeds hydraulically, through the open feed door, to the sluiceway below.

To keep air infiltration to a minimum, ashes are removed from one section at a time. All other feed doors remain closed. Space between ash-hopper feed doors and sluiceway is completely enclosed by cast-iron or steel chambers. Opposite each feed door is an observation door.

If ashes near slagging temperature or large clinkers are expected, design often includes water quenchers. Their spray cools and breaks down to handling size any large or viscous formations. Otherwise, quenchers may be omitted but then a heavier refractory or insulating lining is needed.

Hopper forms a closure for bottom of furnace, to seal it against air infiltration. Water or sand seals are generally used between ash hopper and furnace bottom so it is free to move as temperature changes. Seal troughs allow enough space to prevent contact loading and resulting damage to hoppers or furnace.

7 Are the hoppers for stoker-fired furnaces different?

These hoppers are essentially the same as for dry-bottom pulverized-coal furnaces except that: (1) ashes are nearly always quenched (2) refractory linings are not as heavy, and (3) water or sand seals are seldom needed. Hoppers are not exposed to furnace radiant heat and thus run cooler than pulverized-coal furnace hoppers. Quenching serves largely to break down and cool any large formations. Top of hopper attaches to structural members supporting discharge end of stoker. These members do not move relative to the hopper and hence water or sand seals are not needed.

8 What kind of hoppers for continuous slag-tap furnaces?

Slag hopper consists of refractory-lined steel or cast-iron walls ending at basement-floor level. Feed plate carries nozzles for hydraulic ash removal. Door for closing feed opening at hopper bottom is substantially watertight. It may be operated manually by a handwheel and gears, or by a hydraulic cylinder and piston. A water or sand seal between furnace bottom and hopper top allows for furnace movement while sealing against air infiltration.

Hopper is filled with water to overflow level near top. Molten slag discharging continuously from furnace floor congeals and granulates into small particles when it hits the water. Cool granular slag then drops to the bottom. It is removed during next periodic sluicing. The hopper is dewatered before opening the feed door.

Except during slag removal, cool water enters the hopper continuously

to absorb heat transferred from slag. Warm water leaves hopper at same rate through baffled overflow.

9 How are sluiceways and sluicing nozzles constructed?

Sluiceway generally consists of a concrete trench below basement floor level. It is rectangular in cross section. Horizontal bottom is usually lined with part-round abrasion-resistant liners. These protect concrete sides and bottom from abrasive wear. Trench width usually runs 18 or 24 in. depending on maximum size of solids, conveying rates and sluiceway length.

Cover plates at same elevation as top of concrete floor close sluiceway trench between ash hoppers. Plates are easily removable for access to and inspection of sluiceway nozzles and liners. Gaskets between covers and curb angles seal against leakage of water and ashes.

At intervals along the bottom of trench are nozzles for ash transportation. It is general practice to step down elevation of trench bottom at each intermediate nozzle to provide clearance for it. Nozzle consists of a cast-iron body tapped at inlet for a water-supply pipe connection and at outlet for a replaceable nozzle tip. Flow through body and tip converts pressure energy of sluicing water to high-velocity compact stream.

Replaceable nozzles are made of corrosion-resistant metal. At sluiceway turns and intersections, replaceable wear plates protect concrete from erosion by deflected sluiceway stream.

10 How about sluicing pressures and quantities?

For ashes of average density, from either pulverized-coal- or stoker-fired furnaces, designers usually recommend sluicing pressure of 100 psi. This is pressure measured at nozzles under maximum flow conditions. Operating pressures should be higher, up to 150 psi or more, for heavy slag, large clinker.

Water quantities for various sluiceway nozzles usually range from 100 to 225 gpm, depending on: boiler spacing, nozzle spacing, sluiceway length, number, type and angularity of sluiceway turns, and physical character of material conveyed. It is always important to impart enough jet energy to sluiceway to keep solids moving at rate high enough to prevent settling. This needs careful study for each application and a recommendation based on experience.

11 What types of pumps are used to handle ash?

Ash pumps are generally centrifugal units with single side suction and large openings for passage of solid lumps. Suction sleeve, impeller, volute shell and other parts exposed to wear are of hard abrasion-resistant material. Present practice favors horizontal-shaft pumps that can be serviced in their operating position.

Pump suction pipe extends into bottom of small transfer sump. It picks up a mixture of water and ashes at rate discharged from sluiceway. Pump delivers this mixture through an abrasion-resistant hard-iron pipe to disposal point. There water drains off and leaves commercially dry ash.

Pipeline velocity should be as low as practical but high enough to keep solids in suspension. Too-high velocities cause excessive wear on pump impeller and pipe. General practice is to pump through 6- or 8-in.-dia pipe. Full cross-sectional diameter and area of ash-pump discharge and suction lines should hold throughout entire length of line. Throttling causes plugging. Thus pump heads must balance pipe frictional and static heads and at the same time maintain proper line velocity.

12 What conditions must the ash-pump drives meet?

Designers generally recommend constant-speed normal-torque squirrel-cage motors for ash-pump drives. A multiple V-belt connection allows use of constant-speed motor and standard pump impeller; it rarely happens that required pump speed is same as motor speed. This drive also allows changes, within certain limits, of pump head and capacity. Ease with which this may be done proves important when pumping ashes to fill low land. Elevation of discharge end of line and pipe length change as different areas are filled.

13 How is makeup water to transfer sump controlled?

Volume of water and ashes discharged from sluiceway to transfer sump varies, depending on location of hopper being emptied and other operating conditions. Makeup water from house-service mains is usually admitted to sump under automatic float control. This takes care of any deficiency in pumping water when discharge from sluiceway isn't enough to meet pump capacity. When sluicing water is recirculated, makeup supply comes from recirculating-pump main which supplies water to sluice and hopper feed nozzles.

Ash pumps may be set in a dry well alongside the transfer sump at an elevation that insures self-priming. Or, they may be mounted on the basement floor alongside the sump. This arrangement requires priming equipment.

14 How about recirculating the sluicing water?

With certain types of systems, it is practical to reclaim sluicing and ash-pumping water by recirculation (see flow diagram, p 83). Recirculating pump usually takes suction from surge tank receiving overflow and drainage water from elevated ash-dewatering bin or ash-storage sump. Pump then builds up head and discharges high-pressure water to piping system supplying sluicing and hopper feed nozzles.

Pumps for this service must resist abrasive action of fine silt suspended in water. Single side-suction horizontal centrifugals usually prove a practical answer. Pump may be directly connected, through flexible coupling, to constant-speed (usually 1750 rpm) normal-torque squirrel-cage motor.

15 When is an ash crusher considered necessary?

If much large ash is expected, locate a motor-operated ash crusher at the transfer sump just below the discharge end of the sluiceway. This operates during sluicing to crush clinkers.

16 What is a dewatering storage bin? How does it work?

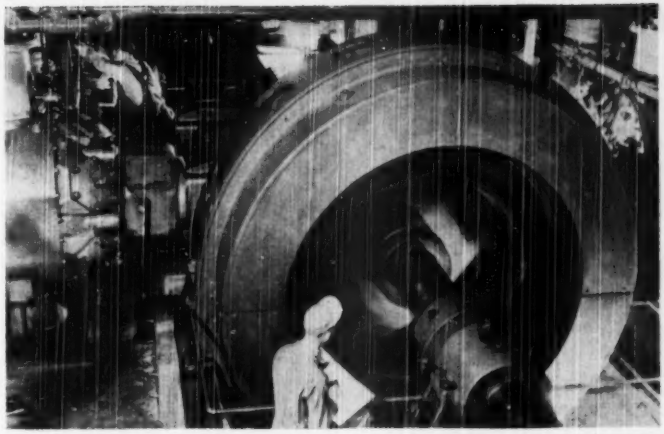
This elevated bin receives water and ashes from ash-pump discharge pipe. Water overflows and drains off. Ash is stored until discharged through a gate to trucks, cars or barges. Bin usually consists of a steel, cylindrical top section with conical bottom, supported on structural members. A gate, high enough to clear trucks or cars, closes off the bottom, provides gravity discharge. Near top of bin, underflow and overflow baffles are installed. Louvers on inner sides of cylinder and cone provide for dewatering contents.

When ash-laden water flows into bin, ashes drop to bottom as water level gradually rises. When bin fills to overflow elevation, ashes continue to drop to bottom but transport water leaves bin through overflow pipe. After ash pump stops, contents stand for a short time to settle out fine ash. Then dewatering valve at bottom of bin is opened to drain off excess water. Louvers restrain ashes while allowing water to leave. After dewatering, commercially dry ashes, containing about 15% water by weight, remain in bin.

Gate door is usually of heavily ribbed cast iron, supported on adjustable rollers. A steam ring at bottom of cone, just above ash gate, prevents gate door from freezing to frame. Hydraulic gate control works from grade level, convenient to truck operator.

Here's Why Motors Overheat

1 Overloading motor when circuit protection is inadequate
2 Low voltage at motor terminals
3 Mechanical defects, bearings
4 Starting winding stays "in"
5 Inadequate motor ventilation
6 High, long starting currents
7 One line open to 3-phase motor
8 Incorrect motor connections
9 Electrical faults in the motor



PERIODIC INSPECTION, first step in spotting local overheating. This lad is checking the largest synchronous motor, in horsepower, ever applied as reciprocating air-compressor drive. Motor is rated at 4500 hp, 300 rpm, 11,000 v, and unity pf

Are Your Motors Overheating?

Youngsters in motor maintenance will benefit from author's survey of causes and cures for overheating; oldsters can take a peek, too

By J L WATTS, *Electrical Engineer, Southampton, England*

► HEAT IS GENERATED in all electrical apparatus while current is flowing. Resulting temperature rise is the principal factor in limiting loading and determining life expectancy. It follows that many breakdowns can be avoided if overheating is noticed, the cause diagnosed and remedied.

General Causes. In normal operation, motor-frame temperature increases more or less gradually after the motor starts. And heat is dissipated at an increasing rate as motor temperature rises. This heat is lost by (1) radiation (2) convectional air currents around machine frame and (3) heat conduction to parts that are in contact with motor. When supply voltage and motor load are constant, machine eventually reaches a steady temperature. Of course, heat rate generated within the motor is then equal to heat given off from the machine. This fundamental is brought out in Fig. 1, p 88, showing temperature rise, measured above ambient, for a small totally enclosed induction motor.

Design engineers hold maximum temperature rise within allowable limits of motor insulation. Exceeding safe temperatures for motor insulation cuts a big chunk from motor's life expectancy. In fact, rated motor load is load that can be sustained for the rated period without damage to electrical insulation or other motor parts. Hence the keynote here is to keep temperature rise within allowable design limits. Where a motor is installed in an exceptionally warm atmosphere, it's good practice to reduce the load to keep within maximum allowable temperature.

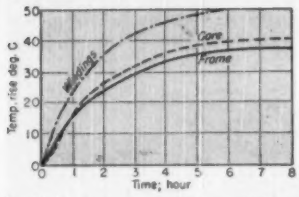
Starting Current. Value of initial motor current depends on design and starting methods. Generally speaking, the starting current of a squirrel-cage induction motor is high when it's started across the line. This current then decreases rapidly as motor speeds up. Motor starting operations should be completed quickly. Otherwise, you'll have increased motor heating because of the prolonged large starting current in addition to reduced fanning action while motor is running at its low speed.

This matter of fast starting is emphasized in a split-phase or capacitor-start motor. Both have a separate starting winding that has a definite short-time rating. These windings are designed to carry current for the brief starting period only. Chances are they'll burn out if the motor is consistently slow in picking up speed, or if the centrifugal switch stays closed a long time while motor is tied into the line.

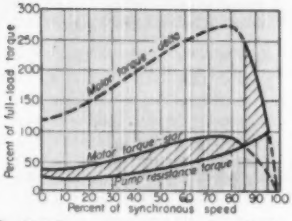
While on this matter of starting current, keep in mind it can be reduced by a resistance, reactor or autotransformer starter. But once again, these devices are generally designed to carry current during a normal starting period only. They, too, overheat if motor acceleration is slow.

And now a few words about slow acceleration. Rate of acceleration is inversely proportional to inertia of rotor and connected load. That's why it takes a long time to get a high-inertia flywheel load up to full speed. Some of these thoughts were driven home in Fig. 2. Curves here cover a Y-delta starter whose motor runs a centrifugal pump. In this case, loading increases with speed. Note that acceleration continues in Y position as long as motor torque is greater than pump resistance. This point is at about 85% of synchro-

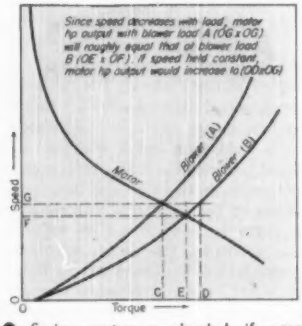
Characteristics That Affect Motor Heating



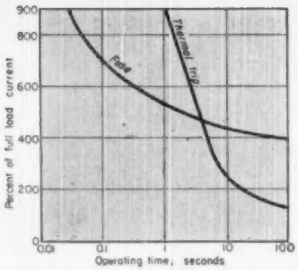
1 Note the temperature difference between windings and motor frame



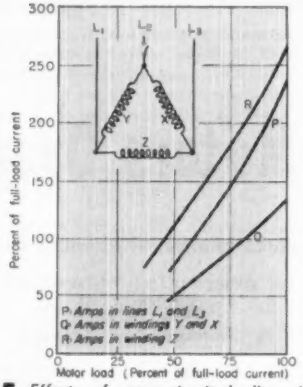
2 Y-delta start torque for 3-phase motor coupled to centrifugal pump


Since speed decreases with load, motor hp output with blower load A (OG x OG) will roughly equal that of blower load B (OE x OF). If speed held constant, motor hp output would increase to (OD x OG)
Speed
Motor
Blower (A)
Blower (B)
Torque

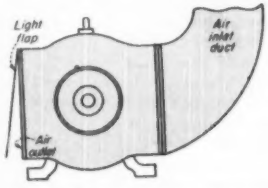
3 Series motor overloaded if speed is held constant at loads *A* and *B*



4 Characteristics of cartridge fuse and one type of thermal trip device


Percent of full-load current
P: Amps in lines L1 and L3
Q: Amps in windings Y and X
R: Amps in winding Z
Motor load (Percent of full-load current)

5 Effect of open-circuited line in a 3-phase, delta-connected motor



6 Suggested arrangement for motor ventilated from common air duct

nous speed. Speed then becomes steady. That's the time to throw starter switch to the delta or run position, putting full voltage across the motor. Increased motor torque—a function of voltage squared—will then rapidly bring your machine up to full speed. And that point is at about 95% of synchronous speed, making due allowance for slip. Shaded area in these curves represents hp to accelerate rotor and pump to full speed that's just below synchronous.

When moving starter handle off the start position, don't let much time elapse before putting in the run position. Otherwise, your disconnected motor slows down appreciably. That means the windings carry a high-surge current when starter reaches running position. Comforting thought is that most starters are designed so they cannot reach running position if *start* to *run* swap is made too slowly. But bad overheating can stem from repeated starting attempts.

Slow Starting. It stands to reason that a motor will burn out if allowed to remain stalled with full current flowing through its windings since no counter voltage is generated. Same thing holds true to a limited degree if acceleration is slow. Latter may be caused by mechanical overload, too small a motor, faulty bearings, poor alignment, tight belt, etc. Then, again, if it's a matter of a long shutdown, starting overload can generally be traced to belt stiffness, oil having drained from bearing surfaces, etc. Here's where the old trick of belt-pulling on starting comes in handy. *(Editor's note:* We frown on belt-pulling from a safety angle.)

REDUCE STARTING LOAD

There are several ways to lick this excess-starting current problem. Of course, one is to swing to a different-type motor starter or simply change the taps on the autotransformer, if one is used. One of the most practical ways is starting up the motor unloaded. Then when the motor reaches its full speed it can be coupled to load through a fluid coupling, clutch, or system of pulleys. Under these conditions, the squirrel-cage motor may apply up to about 250% of full-load torque to the load. At the same time it will be drawing only about two-thirds of the locked-rotor current at about 20% speed reduction.

Motor Loading. An overloaded motor may be quickly spotted by checking the current in each of the motor leads. Simplest and quickest way is with a split-core ammeter. From there on it's simply a matter of comparing instrument reading with the full-load current marked on motor nameplate.

In a 3-phase motor, current should be measured in each phase; they should all read alike. This simple test generally ties down whether the motor is actually overloaded or the winding is at fault.

Another common cause for overheating is low voltage at motor terminals. This results in motor taking more than its rated current to develop rated horsepower. Here's the time to put your voltmeter to work checking terminal voltage while the machine is running under full load. Increased current input for no apparent reason may often be traced to a supply voltage that is lower than motor's rating. Likewise, variation of supply voltage, overloaded transformer or feeders may all contribute to low terminal motor voltage, hence overheating.

Starting Connections. We have already said a few words about leaving

a Y-delta motor starter in the Y position. In addition to that, overheating may also be traced to improper motor connections. For example, take a 3-phase squirrel-cage motor with six stator terminals for use with a Y-delta motor starter. Trouble would crop up if these windings were permanently connected in Y and used with an across-the-line switch. This resolves into running the motor at less than rated voltage.

Then, again, there is always the possibility of a hot or burned-out motor resulting from running a dual voltage job with its winding in series rather than parallel when tapped across the lower voltage.

Voltage Changes. The picture is somewhat different when dealing with dc motors. Here a reduction in terminal voltage reduces shunt field current and flux. Motor then requires a greater armature current to develop a given torque. But motor speed drops under the lower voltage, which tends to limit the hp output—proportional to product of speed and torque. In this way there's some controlling factor on incoming current and resulting motor heating.

But when terminal voltage is increased above motor's rating, shunt field current goes up along with field winding temperature at all loads. In this case the motor speed increases. If the load calls for higher torque at increased speed, armature current and heating increase. Of course, there is a sizable increase in motor horsepower output.

MOTOR PROTECTION

Looking at the ac side of the picture a moment, the first effect under a higher terminal voltage is an increase in magnetizing current. This is true if a normally connected Y stator winding is hooked in delta. In that case, each phase of the stator winding gets the full-line voltage instead of the intended 58%.

There is the problem of running a motor at reduced frequency. Its speed decreases in proportion to frequency change. But the motor will require an increased magnetic field that will be produced automatically since the unit now takes a higher magnetizing current from the line. A rule of thumb to follow is that overheating may be expected if frequency is reduced more than 15%.

Over-Current Protection. It is mighty important that each motor be protected by over-current devices to open the line contactor if overload current is sustained. Except with small motors, hand-operated starters should be the trip-free type. That means they are free to trip as soon as contact tips touch. For best protection, one over-current element should be inserted in each ungrounded line. Practical setting for these thermal trips is about 125% of rated current. This setting should be checked against the *National Electric Code.*

Inherent time-lag feature of the thermal overload device keeps line contactor from operating on momentary overload. In other than thermal devices, this time lag is effected by oil or oil dashpots. Fig. 4 shows the relative operating time of a typical thermal tripping device compared to a fuse. Note that the operating time is appreciably shortened as the overload current reaches a high value.

Remember, most motors have a continuous overload capacity period, usually about 15%. This is called the motor's service factor.

THERMAL CHARACTERISTICS

Generally speaking, the thermal characteristics of many over-current devices are not the same as those of an overloaded motor. That holds true when the thermal trips are in a motor starter that's in a cooler ambient than the point where the motor is operating. We can readily see that the motor under these conditions could be seriously overloaded before the trips would operate. A more realistic approach is used when thermostatic trips are within the motor frame. In that case they operate as a function of the actual motor temperature rather than current flow in motor leads. Thermostat's tripping contacts are connected in the low-voltage release coil circuit of the motor starter.

In a similar manner, fuses often fall short in this job of protecting motors against overload. If their size is such as to handle momentary overloads, and high starting currents, they will not in general protect against sustained but dangerous overloads. This problem in turn is licked by combining thermal elements and fuses in the field of motor protection. But on the whole the straight fuse is quite suitable for protecting small motors that are handling loads not subject to overload. Then, again, they do a fine job in protecting cables, motor starters and motors against short circuits.

This combination of fuses or circuit breakers, in addition to an overload trip, guards against opening the motor starter under short-circuit conditions. The hazard is in attempting to interrupt a heavy short-circuit current with the relatively small interrupting capacity of a motor starter. Note in Fig. 4 that the fuse operates faster than the thermal trip if the current flow exceeds five times normal rating.

Single Phasing. Overheating can often be traced to an open circuit in one line of a 3-phase motor supply. If a motor is running when one phase opens it will continue to run unless heavily loaded. But it will not start with one line open. This trouble can be readily spotted by an ammeter connected successively in each motor line. Instrument will read either zero or more than normal, depending on whether it is connected in the open or through lines. Generally speaking, in this case the overload trip will operate before damage is serious. At least that's the case with a Y-job.

DELTA CONNECTION

The picture is somewhat different for a delta-connected 3-phase motor. Typical experimental results are shown in Fig. 5. We see here that if a motor is carrying 65% of its full load, phase Z of the motor winding will carry 150% of normal current after line L_3 is opened. Heat generated in the windings will be about 2¼ times normal. At the same time, current in the two sound lines, L_1 and L_2, will not reach a high enough value to operate the thermal trip set at 125% rated load. Hence the motor may be left to overheat. This is one case where the thermostatic element embedded in the motor frame would provide good protection.

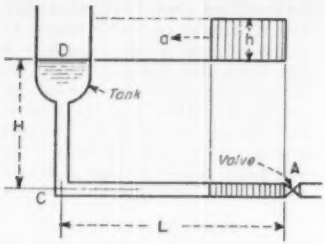
A somewhat more positive approach in protecting against single phasing calls for a current balance relay. In that case the motor is automatically disconnected should the phase currents be unbalanced.

Faulty Ventilation. Another common cause for overheating motors is lack of proper ventilation. Where it is necessary to put a motor in a high ambient it should be shielded from radiated heat and supplied with cool air.

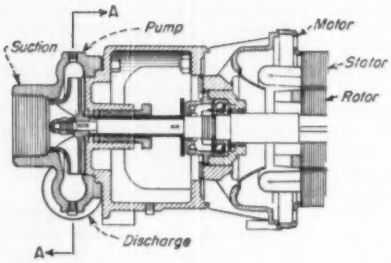
Where there is a lack of free air, motor temperature rises progressively while machine is running. A heat balance is hard to establish until motor temperature is well in excess of its safe limits. A similar case occurs when dirt and industrial waste accumulate on the motor frame. They tend to have an insulating effect, reducing heat transfer from the motor frame. Worse still, if dirt clogs motor vents or accumulates on the windings, it blocks any cooling that may be available. Totally enclosed and enclosed fan-cooled motors should be considered for such spots.

Also, consider mechanical defects that may be responsible for local overheating. Such can often be traced to improper lubricating of bearings, excessive belt tension, or out-of-line shafts, etc. Overheating of an antifriction bearing is often due to excessive greasing.

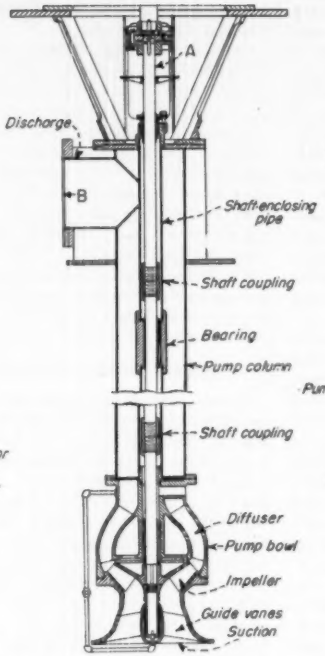
General conclusion from all the above trouble sources is that a high percentage of breakdowns can be avoided by periodic inspection and intelligent diagnosis of cause for undue heating.



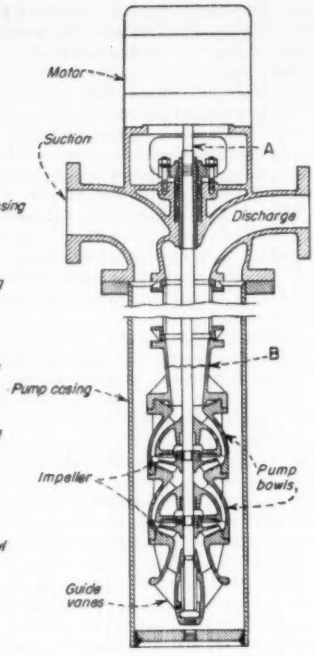
1 Water hammer develops when a valve in a pipeline is closed suddenly



2 Suddenly closing discharge valve cracked volute at *A-A* on this pump



3 Water hammer bent the pump shaft at *A*, damaged expansion joint at *B*



4 Quickly closing a discharge valve bent motorshaft *A*, cracked casing *B*

Putting Water Hammer Under Control

Sudden pressure rises in water pipelines and in centrifugal pumps cause operating engineers no end of trouble. Here are causes of these destructive forces and ways to control them

By **A J STEPANOFF**, *Engineer*
Cameron Engineering Dept, Ingersoll-Rand Co

► WATER HAMMER OCCURS in a closed pipe system when velocity of flow changes suddenly. It may cause an audible blow or pipe vibration if there is a loose part in the system, such as a check valve that slams or a pipe that is not anchored. Piping or pumps have been damaged without giving audible signs. Primary result of a sudden flow-velocity change in a pipe is a rapid pressure rise.

How Much Pressure Rise? This pressure can be calculated easily and accurately with the formula: $h = aV \div g$, where h is pressure rise in feet of water; a is velocity in ft per sec at which the pressure wave travels along the pipe. This pressure wave has the same velocity as sound in a pipe full of water, and depends on pipe size and thickness. For a rough approximation assume $a = 3220$ ft per sec. Factor g is acceleration due to gravity and is equal to 32.2 ft per sec; V is velocity of liquid in the pipe in feet per sec.

Using these values, pressure rise due to a sudden stopping of flow in a pipe becomes: $h = 100V$. In other words, pressure rise in feet of water column is one hundred times flow velocity in the pipe in feet. For instance, if flow is suddenly stopped in a pipe where flow velocity is 8 ft per sec, pressure rise is $8 \times 100 = 800$ ft, $800 \times 0.435 = 348$ lb per sq in.

When pipe flow is suddenly reduced from a velocity V_1 to V_2 (but not stopped entirely), pressure rise in feet equals: $h = 100\ (V_1 - V_2)$. Thus, if flow velocity in a pipe is suddenly reduced one foot, from 8 to 7 for example, pressure rise is $1 \times 100 = 100$ ft, or $100 \times 0.434 = 43.4$ lb.

What Is Water Hammer? The simple diagram in Fig. 1 helps to show what happens in a pipe when flow velocity changes suddenly. Assume water flowing from tank D into a system under a head of H ft with velocity V. If pipe resistance to flow is low, practically total head is available at valve A. When this valve closes suddenly, pressure rises instantaneously to $h = 100V$ ft approximately, at the valve above the existing

head H. Water begins to crowd at the valve and the pressure rise h travels toward the tank with a velocity a of about 3220 ft per sec.

When the pressure wave reaches D, the whole water column is at rest under additional compression due to pressure rise h. After that, water begins to expand at D to its normal state; pressure becomes normal and excess water returns to the tank. Pressure reduction to normal also travels along the pipe from D to A at the same velocity a, as the pressure wave moved from A to D. It reaches the valve in a time $t = 2L \div a$, from the moment the valve closes.

Here, L is the pipe length in feet, t equals the time in seconds for one pressure-wave round-trip from A to D and back. It is called one interval of time and is important in water-hammer calculations. When pressure at A is reduced to normal, water moves away from the valve, expanding from a compressed to a normal state, and pressure drops at A by an amount equal to h ft. When this pressure drop, traveling from A to D with a velocity a ft, reaches D, the whole column is at rest under a pressure below normal. Water then begins to contract to its normal state, restoring its original pressure.

At the end of the second round trip, original conditions prevail in the whole system and a new cycle begins. Thus the pressure at the valve fluctuates from $+h$ to $-h$, above and below its original pressure of H ft. This continues until the kinetic energy stored in the water column is dissipated, each succeeding pressure wave being lower than the preceding one.

Gradual Valve Closure. If the valve closes slowly, pressure rises gradually for one interval of time t. If, during this time, flow velocity is reduced from V_1 to V_2, pressure rise at the valve is $100\ (V_1 - V_2)$, or the same as in a sudden velocity reduction from V_1 to V_2. But in a gradual valve closure, pressure change along the pipe is also gradual with a maximum at the valve and zero at the pipe's open end.

For example, assume a pipe 6440 ft long carries water at a velocity of 8 ft per sec and the valve is gradually closed so pipe flow velocity decreases at a rate of 1 ft per sec. To find the pressure rise we calculate first the time interval $t = 2L \div a = 2 \times 6440 \div 3220 = 4$ sec. Pressure then rises at the valve for 4 sec. In 4 sec, velocity in the pipe drops from 8 to 4 ft per sec and the pressure rise is $h = 100 \times (8 - 4) = 400$ ft, or 171 lb.

Water-Hammer Causes. In systems consisting of centrifugal pumps and piping, water hammer may occur when the pump starts or stops, or when a valve closes or opens in the distribution system. Fig. 3 shows a 20-in. vertical turbine pump for pumping molten salt used as a heating medium in an oil-refinery process. When started against a shut valve and with a column full of air or steam, the 4-in. shaft was bent at A near the coupling and an expansion joint next to discharge flange at B was damaged. But when started with the discharge valve half open and the rotor revolving backward, there was no dangerous water hammer.

If a pump is working against a considerable static head, flow tends to reverse each time the pump stops, and appreciable water hammer may develop even without a check valve in the system. In such cases, the pump presents sufficient resistance to back flow to cause throttling and a pressure rise.

Stopping a vertical turbine deepwell pump is always followed by a reverse flow, reverse rotation and water hammer. In an open-impeller pump, Fig. 4, water hammer causes the impeller to hammer against its seat while rotating. Under such conditions it is impossible to maintain close-running clearances. Nonreversing ratchets, built into vertical motors on such pumps, stop impeller reverse rotation and grinding but do not eliminate hammering or vibration of the pump rotor.

Fig. 2 shows a single-stage motor-mounted pump for gasoline loading. Quickly closing the discharge valve damaged a number of these pumps. The volute casing cracked along its vertical plane, A-A, which is the weakest section of the casing. Stuffing-box troubles, or vibration, observed in similar applications were caused by mild water hammer.

Fig. 4 is a cross section through a vertical-turbine pump enclosed in a suction barrel for gasoline loading. A number of such pumps were damaged by quick-closing valves on the loading rack. The motorshaft was twisted near the coupling at A, and the discharge cone was cracked above the pump's last stage at B.

Reduce Water Hammer. Pressure rise due to water hammer can be reduced only by decreasing the rate of flow-velocity change in the pipe. This can be done in one or several of the following ways:

1. Design pipe systems for low-flow velocities.

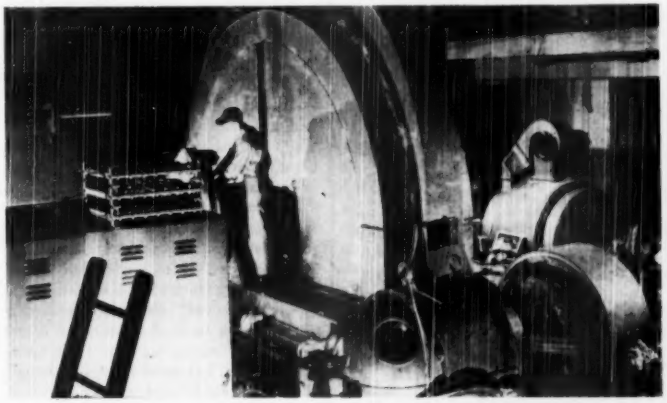
2. Use positively controlled valves combining the functions of a check and a gate valve. The slower the closing rate, the less the pressure rise. Loss of water and reverse rotation of pumps for short periods is seldom objectionable.

3. Use special check valves, such as balanced and loaded. Also, provide a bypass around a check valve that closes slowly after the valve is shut.

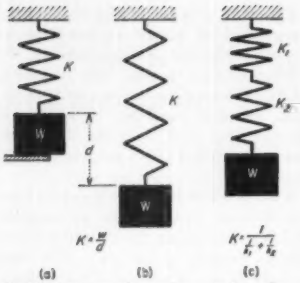
4. Use air chambers, accumulators or surge tanks. To be effective these should be placed as close as possible to the water-hammer source, such as valve or pump.

5. Use relief valves, widely adopted for protection of hydraulic equipment. When provided with a positive control these are known as surge suppressors.

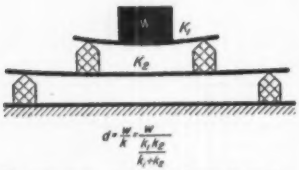
6. Provide high points in pipelines with vacuum breakers to admit air. This prevents parting of water column if, during pressure-wave travel along the pipe, pressure at high points drops below atmosphere.



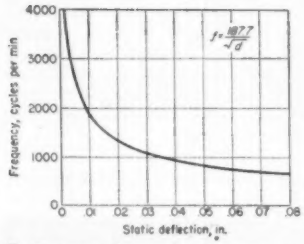
Wound-Rotor Motor Tests. This motor, with associated motor generators and control equipment, is being prepared for tests at Allis-Chalmers. It is a 2000-hp 2300-v 195-rpm wound-rotor type induction unit. It will drive a variable-pitch propeller pump in the new Naval Ordnance Research Laboratory at Pennsylvania State College



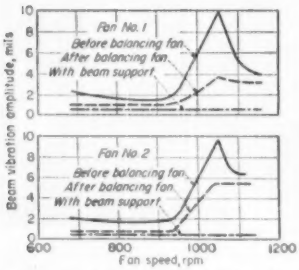
1 Deflections depend on spring design and heaviness of the weight



2 Vibration of system depends on *V* and spring constants of supports



3 Resonant frequency decreases as support static deflection grows



4 Beam vibration amplitude depends on rotating speed of both fans

MECHANICAL VIBRATIONS
Cause and Control—1

Starting a short series on practical examples of vibration problems and their solution. This installment tells about critical speeds of rotating machinery and their effect on the plant's supporting structural steel

By **IRA E CHURCH**, *Field Balancing Service*

► MY FIRST EXPERIENCE with balancing rotating machinery occurred nearly 40 years ago while I was working in the service department of an electrical manufacturing company. We received a trouble call on a 1200-rpm rotary converter of a new design. Many similar 900-rpm machines had run with little trouble after being statically balanced on parallel bars in the factory.

I was sent to do the best I could to satisfy the customer. In those days we had no balancing equipment. A piece of chalk was the principal instrument used to find the high spot on a vibrating shaft. After a number of trials we got the vibration down to a satisfactory magnitude.

Nearly every unit of this series of 1200-rpm rotaries gave the same trouble. Having been "lucky" with the first one I was sent on many similar jobs. What we didn't know about vibration causes in those days has since been discovered and recorded in the technical literature. As I look back, it's a safe bet that those rotaries were operating too near their critical speeds.

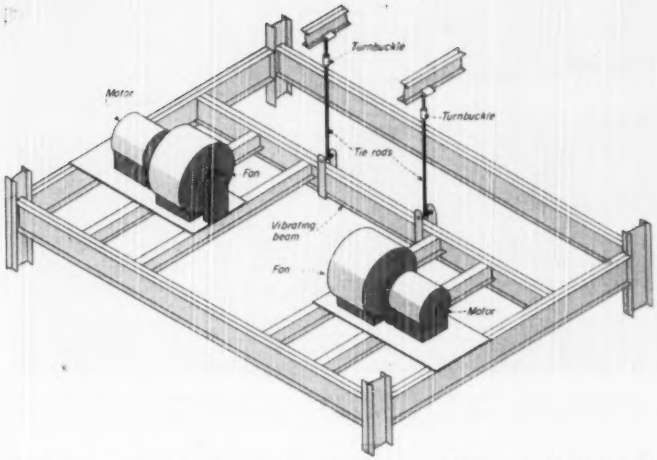
Critical Speed. A rotor shaft must be heavy enough to place its critical speed well away from its operating range. For variable-speed units the critical speed should be at least 125% of the highest operating speed. Constant-speed machines often have their critical speed below their operating rpm. Such units must be well balanced to prevent excessive vibration as they go through their critical speed when being started.

Natural frequency of the foundation supporting the machine must also be taken into account. Mounting units on structural steel always lowers the combined critical speed or frequency of the installation. In one setup three turbine-generators caused so much trouble that changing structural-steel arrangement provided the only solution. Adding supporting columns between twin condensers hanging from the foundation steel work altered the critical frequency enough to cut vibrations to safe levels.

Motor-generator sets, centrifugal pumps and other equipment mounted on floors often cause vibrations that cannot be eliminated entirely. Induced-draft fans mounted on or near the roof are one of the most troublesome devices in a power plant. They have large shafts, 9 to 15 in. in diameter, because distance between bearings is great and because their critical speeds must be brought above their operating speeds. Building columns and supporting beams, however, may be light enough to bring the combined critical frequency down into the operating range.

I was called in recently to balance one fan of a bank that had defied all efforts of station personnel. They had no trouble balancing the other fans. We found a set of fifteen 3-in. conduits hanging from the same beams supporting the fan bearing. These loaded the beams enough to bring the combined critical frequency into the operating range. The fan was only slightly out of balance. In fact, beyond cleaning out dust accumulation it could not be greatly improved. The only solutions were to find different supports for the conduits or limit the fan speed.

In another case, two forced-draft fans, operating at the same speed from a



5 Center beam supported on cross beams vibrated excessively when either or both induced-draft fans it carried ran at operating speeds. Tie rods solved problem

common drive, varied enough in vibration to cause a building beam to vibrate dangerously at a low frequency. Where several constant-speed induced-draft fans mount on or near the roof, a few revolutions difference in speed has set up a low-beat frequency of the building columns. This has resulted in loosening large coping stones on roofs and shearing rivets in stack breechings.

Flyash erosion often throws induced-draft fans out of balance within a short time, making it necessary to service them several times a year.

ELEMENTS OF VIBRATION

All suspended elements in a powerhouse, which includes almost everything, have their own natural vibration frequencies. These can be excited by other vibrations whose frequencies are even multiples. This fact must be understood by anyone undertaking equipment balancing. Much time may be wasted by trying to balance out vibrations not caused by unbalance.

Fig. 1 illustrates the elements of mechanical vibration. Weight W firmly attached to the spring with a constant K does not place the latter under tension when supported as in a. Upon removing the support as in b the weight will sag to lower position through the distance d. From the formula for a spring constant, $K = W/d$, any one value can be found if two are known. For a weight of 2 lb and a deflection of one in., the spring constant is 2/1 or 2 lb per in.

When hanging the spring from a vibrating beam we find that at a certain frequency the weight oscillates wildly. This is the natural frequency of the combination and can be figured as follows:

$$f = \frac{60}{2\pi}\sqrt{\frac{12Kg}{W}}$$

Substituting for K from the spring-constant formula and entering for $12g$ its equivalent value of 386 in. per sec per sec, this formula reduces to:

$$f = \frac{187.7}{\sqrt{d}}$$

The frequency can be expressed as rpm or cycles per minute. In the example just cited where d equals one inch, a critical frequency of 187.7 cycles per min will make the spring-weight combination vibrate up and down through a wide amplitude. Damping limits the amplitude; its amount and nature influence the velocity and acceleration of the vibration. For a vibration following a pure sine wave in its oscillations, velocity = (amplitude)^2, and the acceleration = (velocity)^2. With a distorted wave shape of oscillation, the velocity and acceleration might reach dangerous proportions with only a moderate value of amplitude.

In Fig. 1c, each spring has its own constant. When hung together the springs have a combined constant of different value. This also applies to the frequency, which can be found by the formulas just given. In like manner, each supporting member in a powerhouse has its own natural frequency. In combination with other members they can respond to many more frequencies. The number of these is so great that the building designer finds it impossible to avoid them all.

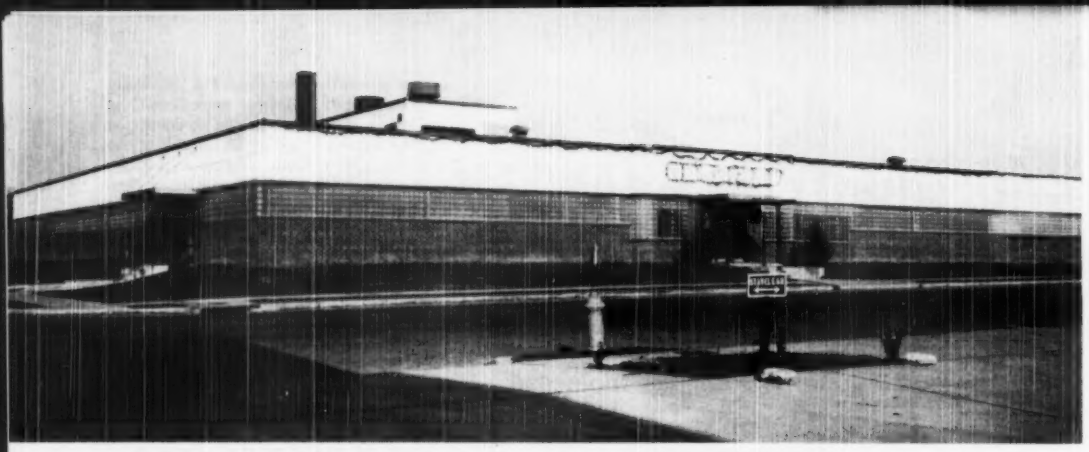
For instance, a motor-driven exciter on a turbine-room floor can be shown as a weight on two or more beams, as in Fig. 2. If the unit ran at 1800 rpm and caused a sag of 10 mils, it would take only a slight unbalance to cause excessive floor vibration, see Fig. 3. The curve shows that a static deflection of 0.01 in. corresponds to a critical frequency of 1877 rpm. Two things can be done to move this critical away from the 1800-rpm point: (1) Add more weight to lower the frequency. (2) Reinforce the floor to raise the resonant frequency.

I have had little success with increased loading. If reinforcing is carried too far there is danger of getting into another critical range. In one case, we welded an 8-in. I-beam to a 12-in. floor beam, raising the critical frequency by about 50% and reduced vibration by one half. Calculations showed this to be better than adding another 12-in. I-beam. Often, however, getting a nearly perfect balance on the equipment reduces vibration to a safe level. In one station a battery-charging set mounted on a balcony excited vibrations in piping in the adjacent boiler room. These were eliminated by mounting the set on a cork pad and balancing its rotor to a precision of ¼ oz.

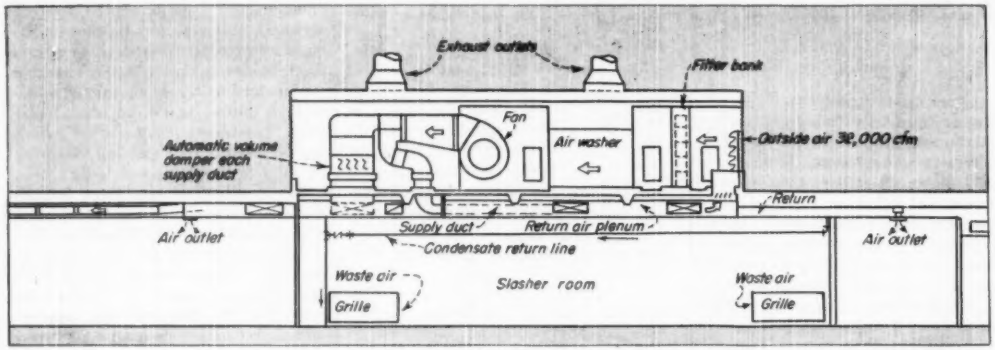
Fan Problem. In one plant, I dealt with two fans supported on a beam that showed excessive vibrations, Fig. 5. Before balancing the fans, readings were taken of beam vibration with each fan running at speeds from 700 to 1140 rpm, Fig. 4. Maximum vibration occurred between 1000 and 1100 rpm, which was the normal operating speed. The fans were balanced till the shaft vibration was only a half mil. But the beam vibration was cut by only about half when one fan was running, and varied from 0 to 10 mils when both fans ran at slightly different speeds.

This beam needed strengthening to shift the curve to the right, enough to get it out of the fan operating-speed range. Changing the critical from 1050 to 1300 cycles per min would be enough. Had this beam been mounted between upright columns, its ends could have been strengthened with braces. But, this beam was carried by two cross beams.

There were two I-beams, 12 ft apart, supporting the floor above. These beams ran at right angles to the vibrating beam below. We hung two tie rods from these floor beams to connect with the vibrating beam through stirrups. Turnbuckles allowed adjusting the tension so the upper beams would not be overloaded. Only a little tension was needed to bring the vibrating beam to rest. The stirrups were near the I-beams that transmitted the vibrations from the fan bearings. This scheme reduced vibration in the whole plant.



1 Single-floor construction, with 4½-ft glass-block strip running horizontally around entire building, features new textile plant of Narricot Co. Plant climate is under the control of a combined radiant-heating and air-conditioning system



3 Air-conditioning system employs a central apparatus room. Conditioned air goes out to five zones. Any of this air to be exhausted returns through the slasher room. So this room stays comfortable, and yet adds no load to air conditioning

Split Air-Conditioning System Raises

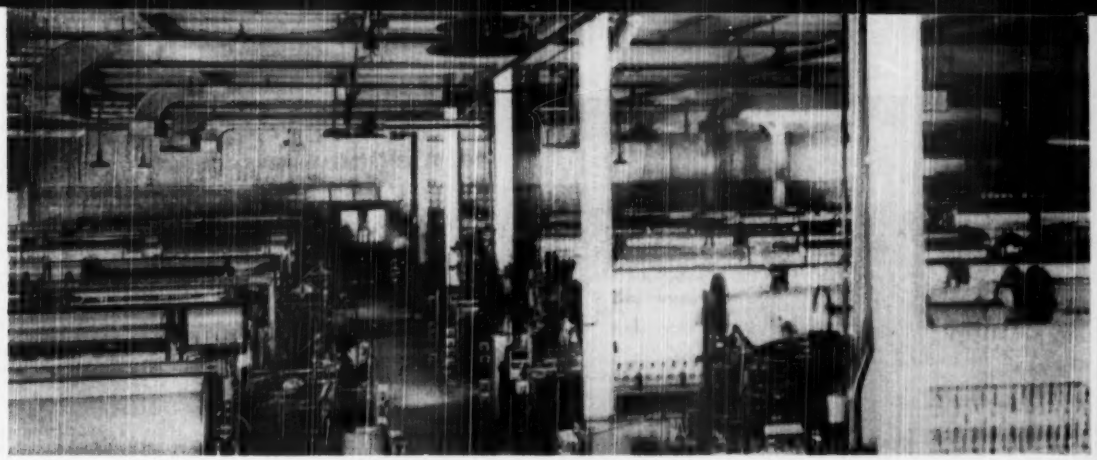
Production at Narricot Co, a Philadelphia textile firm, went up and down with the weather in the old plant. But air-conditioning their new setup with a split system corrected that. It gave a better control of product, a much improved plant efficiency, and boosted the over-all operating profits by an estimated ten percent

► The Narricot Co of Philadelphia, narrow fabric producers, found that great variations in temperature and humidity (summer to winter) seriously impaired constant peak-production planning. Very low winter humidities caused (1) wooden looms to operate sloppily because wooden parts contracted (2) yarns to lose moisture (3) static electricity to become objectionable. Highly humid summer conditions swelled these wooden-looms so badly they shut down.

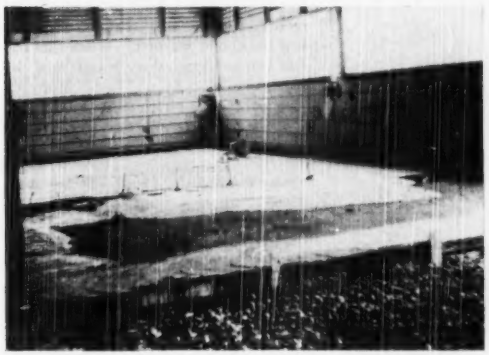
Its new air-conditioned mill, Fig. 1, maintains conditions within 1-F dry-bulb and 1% relative humidity, 24 hours daily. Now with planned capacity, quality control, worker output at a higher level, the mill shows a 10% increase in operating profits.

Plant Layout. The new plant is laid out around the split air-conditioning system. Those departments requiring considerable table work are spotted around the outside walls in what makes up the north, south, east and west zones of the air-conditioning system. These walls have a 4½-ft glass-block strip running around the entire building. While this glass-block area gives excellent natural lighting for the workers it represents a heavy "cold-wall" drain on heating comfort. In addition, it tends to set up heavy down drafts that must be balanced. Just how this problem is solved is discussed below under radiant heating.

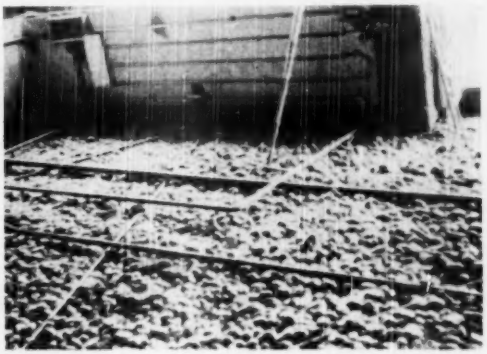
Most of the textile operations are carried on in areas served by air con-



2 Some idea of the equipment arrangement and the load placed on the air-conditioning system can be gained from this view of the loom department. At first, air distribution in this area was a problem, but it was solved satisfactorily



4 Each wall coil has its own water-flow balancing valves; supply and return piping are from the hot-water converter



5 The special coil-supply piping, Fig. 4, was set around edge of floor slab in 4-5-ft space between slab and wall

Textile Plant's Profits

By DON DORFMAN, *Lehigh Engineering Co*

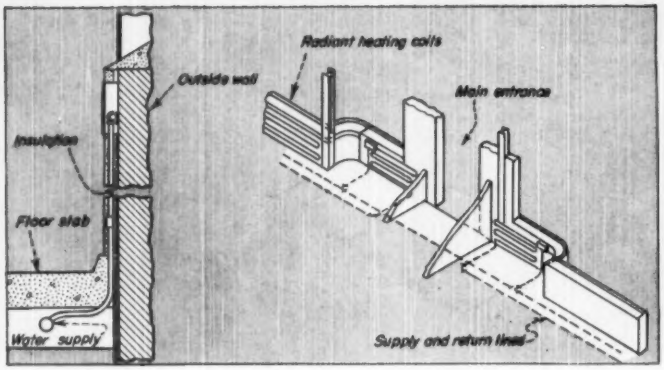
ditioning. The slasher room, though, is located in the central or interior zone but completely shut off from it by walls, Fig. 3. There are screened openings in the slasher-room walls through which all conditioned air to be exhausted must pass. Once this waste air gets into the slasher room it leaves by (1) automatic dampened vent that connects to the air-conditioning apparatus room (2) ceiling exhaust to atmosphere for removal of slasher-machine fumes and vapors.

By putting the slasher room in the path of the exhaust conditioned air, an appreciable saving results for the air-conditioning installation. Equipment in this room takes considerable steam—the amount depends on the yarn being handled. A variable fraction of it escapes to atmosphere and, in addition, there is a radiation- and convection-heat gain from the equipment. If this relatively heavy heat load were added to the plant air conditioning, refrigeration machinery would have to be much larger. Instead, the flow of exhaust conditioned air through this room and into the air-conditioning penthouse holds these spaces at a reasonably comfortable temperature even in the warmest weather.

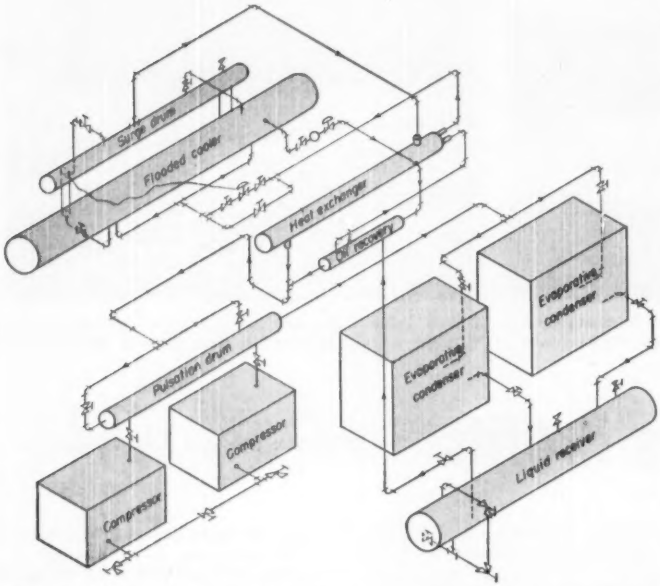
This textile plant put still another special problem on the air-conditioning system. It involved an air outlet for duty in the loom section. These looms, Fig. 2, ordinarily carry a top castle that gives little clearance between air outlet and machine. Air from these outlets could not be at too high a velocity nor too directional because there was a strong possibility of tangling up yarn ends on the machines. The contracting engineers, Lehigh Engineering Co, designed an air outlet, Fig. 8, that met these requirements.

The looms operated with top castles for a year, then the machine itself was redesigned, Fig. 2. Now the yarn ends feed through to the back like a broad-loom, and the air-supply problem no longer exists.

Radiant Heating. The air-conditioning system is a split design because of the heavy outside-wall load. The "skin" or outside-wall heating is handled by a radiant-heating installation mounted in



6 An insulated barrier reaches down 3 feet from the floor level and separates floor slab and outer wall. Outer walls have an insulation lining behind coils



7 Refrigeration cycle has two vapor compressors delivering hot gas to evaporative condensers. Liquid from condensers goes to a heat exchanger and a flooded coil

the lower section of the walls, Fig. 4, 5.

At the time of construction certain very definite steps were taken to help the final heating installation. An insulated barrier reaches down three feet from the floor level and separates floor slab and outer wall, Fig. 6. This increases the resistance to heat emission from slab to wall. Outer walls have a lining of insulating material between the facing brick and the radiant-heating coils. The coils cover the lower wall surface up to the bottom of the glass-block section, a distance of about five feet above floor level.

Each of the walls has its own supply and return piping from the hotwater converter in the boiler room. This piping system was set around the periphery of the floor slab in the 4-5-ft space between slab and wall, Fig. 5 where temperature losses from the floor slab would ordinarily be highest. Each coil assembly has its own water-flow balancing valves mounted in a wall box. Box cover of these adjustable valves is flush-mounted on the plaster finish.

Controls. Control system for the four walls is by zone—north, south, east and west. Up near the glass block on each wall are the zone control instruments. When sun-effect builds up on a given wall the zone control gradually cuts back on the hot-water flow to the radiant coil. Finally, this supply stops altogether so the zone can gain whatever heat pickup the sun's effect gives.

Over and above this throttled supply is a discharge temperature controller on the hot-water discharge from the converter to all zones. This over-riding control works on a predetermined schedule tied in with outside dry-bulb temperatures. In this case, shutoff temperature is 65 F but it is adjustable. As the outside temperature drops, discharge water becomes warmer. When this outside temperature rises water flow becomes cooler. At 65 F, outdoor dry-bulb-water circulation to all zones stops. Steam to the hot-water converter shuts off. This makes the radiant-heating installation completely inoperative above the 65-F setting.

These controls serve as limiting devices rather than as modulating ones to satisfy a given space condition. Reason for this arrangement was to avoid complicated instrumentation since there was no conventional method of simply measuring and controlling radiant - heat effect. Lehigh Engineering Co, the contracting engineers, based their calculations of design on enough heating surface to offset only the "cold - wall" condition and the down draft set up by the glass-block walls.

Air Conditioning. A special penthouse on the roof of the building above the slasher room, Fig. 3, houses the major air-conditioning equipment. Incoming fresh air and return air from the return plenum mix in controlled portions before passing through an electrostatic precipitator, followed up by a bank of replaceable viscous filters. The clean, mixed air continues through an air washer over a set of cooling coils, and then to the dual suction of the main fan.

A wide-range automatic-reset dewpoint-indicating controller determines the dewpoint-temperature condition of air leaving the central air-conditioning apparatus. This control proportions: (1) mixture of fresh to return air passing through the filter bank (2) injection-type water heater for the air-washer spray (3) program controller for a 4-step refrigeration cycle—all in proper sequence to maintain the desired dewpoint temperature.

PRINCIPAL HEATING AND AIR-CONDITIONING EQUIPMENT

The Narricot Company, Philadelphia, Pa.

STEAM AND HEATING:

Boilers, two, 3000 lb per hr, 15 psi Oil fired	International Boiler Works Co
Boiler, one, 1200 lb per hr, 100 psi Packaged, oil fired	Cyclotherm Corp
Boiler, one, 2400 lb per hr, 100 psi Packaged, oil fired, Amesteam	Ames Iron Works
Converter, one Storage hot water, radiant heating	Patterson-Kelley Co
Controls, boiler	Minneapolis-Honeywell Regulator Co
Meters, boiler	Brown Instruments Div
Coils, heating, cooling	Trane Co
Unit heater, one Ceiling mounted, loading platform	Trane Co
Insulation, refrigeration, piping	Mundet Cork Corp
Traps, heating, air conditioning	Sarco Co
Pumps, one, condensate return	Federal Co
Valves, mixing, balancing	Powers Regulator Co

AIR CONDITIONING:

Precipitators, electrostatic	Raytheon Mfg Co
Washer, air Spray type	Lehigh Engineering Co
Filters, air Replaceable, metal frame	Air Maze Corp
Fan, one Dual inlet, Vortex damper	Trane Co
Ductwork Beth-cu-loy, galvanized steel	Lehigh Engineering Co
Regulators Static pressure	Powers Regulator Co
Regulator, temperature Dewpoint, wide range, automatic reset	Powers Regulator Co
Recorder, strip chart Temperatures, zone, dry bulb, hot water, etc	Brown Instruments Div

REFRIGERATION:

Compressors, two, 50 ton Condensers, two, evaporating Receiver, liquid Tank, surge Chiller, flooded Pump, chilled water	Worthington Pump & Machinery Co

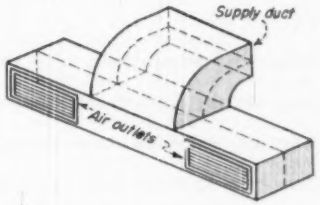
An outside thermostat works in series with the dewpoint controller to set the fresh- and return-air proportions. When the cooling season comes on, this thermostat automatically closes the fresh-air damper to its minimum position (about 15% by volume); opens the return-air damper; and leaves the dampers inoperative in this position for remainder of the cooling season.

The conditioned air is then admitted to the respective zones through the connecting ductwork. Individual zone thermostats control the volume dampers and the valves on the reheater coils in these ducts to deliver air at the proper dry-bulb condition for their particular zone. To prevent the danger of possible "overblowing" in the different areas because of the throttling action of the zone-volume dampers, a static pressure regulator maintains constant static pressure on the main trunk discharge line by throttling vortex dampers on main fan suction.

There are several exhaust fans in the mill, cafeteria, rest rooms and slasher rooms. When these fans start up, the regulator throttles an automatic relief damper that funnels all waste air through the air-conditioning apparatus penthouse.

As the exhaust fans shut down, the regulator opens the relief damper to the penthouse. In addition, the regulator senses and corrects the exhaust for increased amounts of fresh air brought into the system—by the dewpoint controller, above. Result is a positive air pressure within the building at all times so infiltration losses do not occur.

Refrigerating Cycle. Behind the air-conditioning system stands its sources of heat and cold. Heat originates in two 3000-lb-per-hr 15-psi boilers. Incidentally, higher-pressure steam for process needs comes from other boilers, see Equipment Table. Steam from the low-pressure boilers goes to hot-water converters for the radiant-heating coils and plant hot-water needs.



8 Special outlets for air distribution solved loom-section problem, Fig. 2

Chilled water for air conditioning comes from the refrigeration cycle in Fig. 7. Two compressors, 84-ton total capacity, handle the returning refrigerated vapor under the direction of the programming control above. Each compressor has capacity reduction unloaders. This control determines which of the two units stays on to carry the base load. The other comes on only (1) if the load requires it (2) after a stated period decided by the programming control. This way the major equipment pieces have the same service life and give the best return on investment.

The chilled-water refrigeration cycle employed here is known as a flooded cooler system with low side float control. All water that is sprayed in the air washer recirculates by pump action from the air-washer pan through the flooded cooler into the washer spray nozzles continuously.

Liquid refrigerant feeds to the flooded cooler through a pilot-operated modulating valve controlled by a low-side float. The float maintains a constant liquid refrigerant level in the cooler. The greater the heat load imposed, the greater the rate of evaporation within the cooler, calling for a greater rate of flow of liquid refrigerant to the cooler to maintain the same liquid level. The modulating valve and float, above, automatically meets this demand and holds level steady.

An oil-recovery device below the cooler reclaims as much of the oil unavoidably carried over with the refrigerant as possible. This oil is highly soluble in the Freon-12 refrigerant.

After liquid refrigerant evaporates in the cooler it boils off through the surge drum mounted above the cooler. Compressors draw this gas from the surge drum through a heat exchanger, which also has liquid refrigerant flowing through it. Returning gas picks up heat from the liquid refrigerant to superheat the gas and subcool the liquid. This subcooling (1) produces system gain of about 0.5% per degree of subcooled warm liquid (2) protects compressors against any raw liquid striking the intake valves.

The Freon-12 refrigeration compressors pump the gas to two evaporative condensers where the hot gas condenses to liquid refrigerant. Evaporative condensers were selected because of their comparatively low water consumption, 4-5% of that required by a surface condenser.

Liquid refrigerant then flows to liquid receiver to repeat the cycle.

IF YOU COULD BUY ONE OR MORE OF THESE BONDS, WHICH WOULD

Insulation Handbook: Part 3

Which Thickness Pays Best?

Editor Phil Swain tells why the thinnest insulation generally pays out the fastest, yet is rarely the best investment. Future chapters will tell more about heat and dollar savings—also, how to select and apply the various insulating materials

► How thick should heat insulation be? The thicker the insulation, the more heat saved. But how do you figure how much is enough?

It's important to think straight on this matter before plunging into a lot of practical details, so this brief article will concentrate on the reasoning. After the logic is clear, the practical application will be easy.

As an investment, heat insulation differs from security investment in several respects. First, when you apply a reasonable thickness of insulation to a heated surface you often get a yearly return of more than 100% on your money—and with all the safety of Government bonds.

Yet few of us will become millionaires by this kind of investment because the amount we can invest is always limited by the area of the existing bare heated surfaces in our plants.

Nor can we get rich by building up the insulation thickness indefinitely. Heat and dollar loss from the bare surface puts an absolute ceiling on the possible savings by any conceivable thickness of insulation. The first inch or two plugs most of this bare-surface loss. All subsequent inches can do is to save part of what would escape from the under layers alone.

This line of thought leads directly to the standard method of finding the so-called "economic thickness"—the thickness that is the wisest investment. Strange to say, this is not the same as the thickness that yields the highest percentage return on the total dollars invested. In fact the thinnest available commercial thickness generally yields the highest percentage return, yet is rarely the best investment.

Like Buying Bonds. To clear up this puzzle let's think through a parallel case in an imaginary investment market. Suppose some very good friend should offer to sell you the unusual bonds pictured at the top of this page. He will let you buy any you wish for $100 each, but only one of each.

Let's assume, in this imaginary case, that the safety of both interest and principal is beyond question.

Naturally you reach first for bond *A*. In this deal you make no mistake. You will get $24 per year for your $100, and that's 24%.

Nor do you hesitate about buying bond *B*, which is good for 12% per year, on your second $100.

Unless you are hard pressed for cash, you will probably find bond *C*, paying 6%, also worth while. We shall assume that you are not interested in getting 3% on bond *D*. So, for $300 you buy a yearly yield of $24 + 12 + 6 = \$42 = 14\%$.

Now certainly every move you have made has shown sound business judgment. Yet when you added bond *B* to bond *A* you cut your percentage return on your total investment from 24% to 18%. Adding *C* reduced it to 14%.

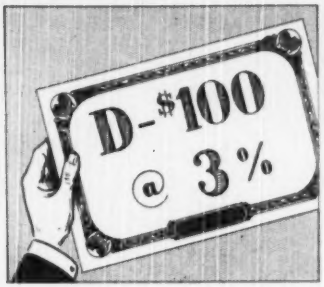
Highest Return, Wisest Buy. So here you have a strange situation where an 18% return is more "profitable" than a 24% return, and a 14% return more profitable than an 18% return.

What you have done is to assume a series of small limited investments arranged in decreasing order of attractiveness. You start at the head of the list and work down, taking each in turn until you reach one that ceases to attract. Then you stop. You have made the wisest total use of your money, yet you are surely getting a smaller percentage return on your investment than if you had stopped with the most favorable investment item offered.

Figuring Economic Thickness. Now this imaginary bond-buying setup exactly parallels what an engineer, skilled in heat-insulation economics, does when he selects the "economic thickness" of insulation for a given set of conditions.

He considers the various thicknesses commercially available and figures for each the total yearly heat loss in dollars. His first (and best) investment is the first thin layer applied to the bare surface. Next he figures how much more

YOU SELECT?..... THAT'S HOW YOU DECIDE THE THICKNESS OF HEAT INSULATION



A	Yields 24 %	◀ This is good.
A + B	Yields 18 %	◀ This is better.
A + B + C	Yields 14 %	◀ This is still better.
A + B + C + D	Yields 11 %	◀ Not so good.

the next thickness costs and how much more it will save. If this *additional* saving is an adequate return on the *additional* investment, he decides to go that far.

Then he treats the next possible step in the same way—and so on until he reaches the point where the game is no longer worth the candle, the point where any further increase in thickness doesn't yield a reasonable return. That is the proper stopping point, the economic thickness.

Stacking Up Sheets. Now let's work this out for an idealized case where the insulation is available in flat sheets 1 in. thick and costing $1.00 each. Assume that these can be stacked up on a level heated surface without any installation cost.

Assume, also, that heat losses (in dollars) are as indicated in Table I for the area covered by the sheets.

Here the first layer is truly a wonderful investment, paying 150% yearly. With the first layer on, however, there is no further opportunity for such a killing, but the 22% return on a second layer is still attractive. Usually the owner will also be interested in the 9% return on the third layer, but probably not in the 5% on the fourth.

Here, then, the economic thickness (the best all-around investment) is the 3-in.

Yet, as shown in column 5 of Table I, the percent return on the total investment is 150% for 1-in., 86% for 2-in. and 60% for 3-in. Here, as with the bonds, the minimum investment is not the best investment, although it yields the highest percentage return.

Practical Example. Turning from this simplified case to an actual situation, we note several differences. First, the greater thickness considered may not be obtained by adding layers, but by substituting thicker layers. Yet the same logic holds here. We merely consider the *difference* in cost and the *difference* in yearly saving for each step in thickness.

Again, in our simple illustration, we neglected the cost of application. We also assumed that each layer cost the same as every other. Obviously the *applied* cost of 2-in.-thick insulation will be less than double that for 1-in.

Table II gets down to a practical case. Columns 2 and 3 show, respectively, actual contract prices for a complete job (insulation of a heater) and actual yearly heat losses in dollars. Note that the half-inch increment from 2½ in. to 3 in. pays 13% while that from 3 to 3½ pays 9%, indicating that either 3-in. or 3½-in. total thickness would be reasonable.

Most plants would not consider the 5% return for the next increment worth while, so would stop with 3½-in. thickness. In any given case the choice will depend on the ease of getting investment money, other possible uses for the available cash, the stability of the business, and other local factors.

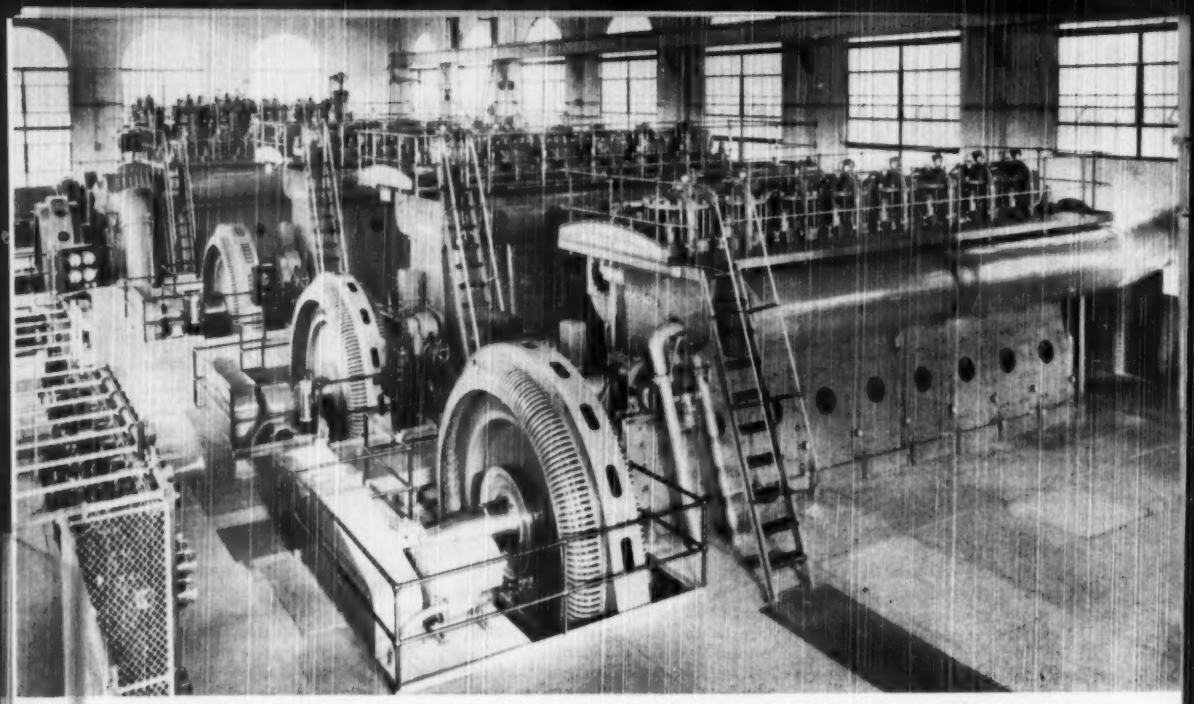
Later chapters of this handbook will show how to figure losses for various thicknesses and how to determine the economic thickness of heat insulation for specific conditions.

I: EFFECT OF STACKING UP LAYERS 1 INCH THICK

No. of layers	*Total investment, $*	*Total yearly loss, $*	*Total yearly saving, $*	*% return on total investment*	*Investment in last layer, $*	*Yearly savings, last layer, $*	*% return, last layer*
0	0	2.00	—	—	—	—	—
1	1.00	0.50	1.50	150	1.00	1.50	150
2	2.00	0.28	1.72	86	1.00	0.22	22
3	3.00	0.19	1.81	60	1.00	0.09	9
4	4.00	0.14	1.86	46	1.00	0.05	5

II: BID ANALYSIS FOR INSULATING HEATER

Thickness, in.	*Total cost installed, $*	*Total yearly heat loss, $*	*Cost of increment of thickness, $*	*Yearly saving from increment* $	%
0	0	360	—	—	—
1	200	90	200	270	135
1½	260	63	60	27	45
2	318	48	58	15	26
2½	374	38	56	10	18
3	429	31	55	7	13
3½	484	26	55	5	9
4	539	23	55	3	5



LINEUP OF 12,550 HP in 2-cycle diesels at Carthage, Mo. Next to last unit in row, with scavenging blower visible, is new 3600-hp engine, which replaced a 1250-hp diesel. Engine in front, rated 3200 hp, was installed in 1946 (see table)

When engineers at the Carthage, Mo., municipal plant put in a 1949 diesel on a foundation installed for a 1924 engine, they found that 25 years of design advances yielded . . .

Almost Three

Summary of Generating Units, Carthage, Mo.

Unit No.	Date installed	Engine rating, bhp	Stroke cycle	Speed, rpm	Fuel injection	Type of scavenging	Retired
1	1921	750	2	180	Air	Pump	1946
2	1924	1250	2	180	Air	Pump	1949
3	1928	1250	2	180	Air	Pump	——
4	1936	2250	2	225	Mech	Pump	——
5	1938	2250	2	225	Mech	Pump	——
6	1946	3200	2	225	Mech	Blower*	——
7	1949	3600	2	225	Mech	Blower**	——

*Separate motor-driven scavenging blower. **Direct-drive Roots-type blower.

Plant Performance, Year Ending June 30, 1949

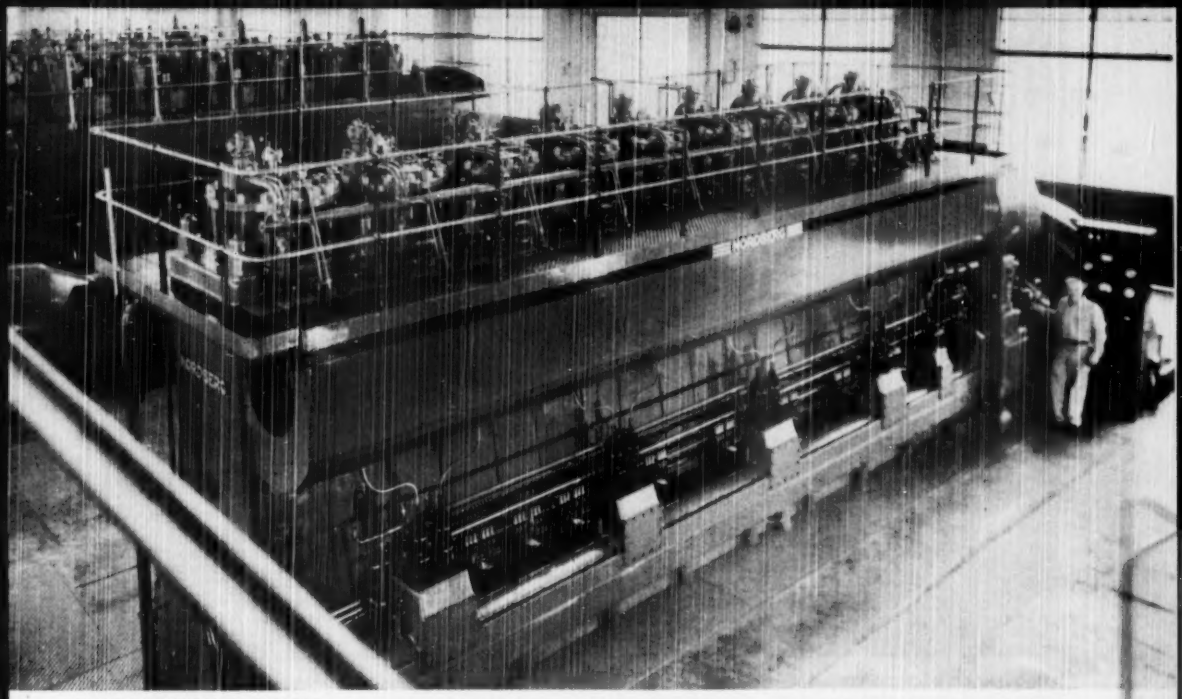
Unit No.	3	4	5	6	7
Date installed	1928	1936	1938	1946	1949**
Capacity, bhp	1250	2250	2250	3200	3600
Hours operated	1452	3606	3630	6879	1983
Generation, kwhr	664,760	3,292,200	3,249,460	12,035,000*	3,615,430
Fuel-oil consumed, gal	66,974	268,679	263,408	809,818	258,781
Kwhr per gal fuel	9.9	12.3	12.3	14.9*	14.0
Lube oil consumed, gal	888	1771	1733	3949	1166
Rated bhphr per gal lube oil	2045	4580	4755	5580	6120

*Gross: Does not deduct power for scavenging blower. After blower power is deducted, net kwhr per gal of fuel oil figures to 13.2. **Started operation March 30.

►IF YOU TRAVEL WEST on U.S. 66 into southwestern Missouri, you'll find a town called Carthage at the junction with U.S. 71. If you've been around diesel men, you'll know it as the home of one of the largest municipal plants in the country. You'll know it also as one with a long record of good operation. But unless you've been there recently, you won't realize one of the most interesting things about it.

To see what we mean, let's look back a bit. Carthage began generating with diesels in 1921, starting with a 750-hp Type EG Nordberg. As the city grew, the plant grew with it. The table, left, tells the story of engines added. In 1946, the first engine was retired and a larger modern engine installed. This was repeated in 1949 and therein lies the point of interest.

Going into the plant today, you see the 1949 engine standing on the foundation originally put in for the 1924 unit it replaced. The new unit turns out 3600 hp compared with 1250 for the old one. A little quick arithmetic tells you that means almost three times as



LATEST ADDITION IN CLOSEUP: injection-pump side of 9-cylinder blower-scavenged unit. It is designed to operate as an oil-burning diesel or as a dual-fuel engine. Present plans call for converting it, and No. 6, to dual-fuel operation

Times as Much Power in Same Space

much power in the same space. But, you'll say, what's happened to rotative speed? Much to your surprise, Ward Chittendon, chief engineer, will tell you it's only up 25%. From 180 to 225 rpm, in fact. And if H J (Herb) Williams is around (he's general superintendent) he'll tell you that the new engine is easier on fuel and lube oil than the old one. What's more, he'll trot out records (as in table) to show you cold figures.

Some Comparisons. By this time, your appetite for more dope will be nicely whetted. You'll want to stick around awhile and make some comparisons. They'll be interesting ones. They'll show what diesel designers have done in the past 25 years to boost engine output and efficiency. And the comparison will be a fair one, because both new and old (as well as the other Carthage engines) are products of one builder—Nordberg.

Here are some of the facts you'll dig out on the 1924 EG engine: At 180 rpm, it turned out 250 hp per 20¾x26-in. cylinder. Bmep was 62.5 psi. It developed 49 bhp per cu ft of cylinder displacement with a piston speed of 780 fpm. Then you'll find the 1949 model stacks up like this: At 225 rpm it turns out 400 hp per 21½x29-in. cylinder, with bmep up to 66.6 psi. A cu ft of cylinder displacement now develops 66 bhp, with piston speed at 1090 fpm.

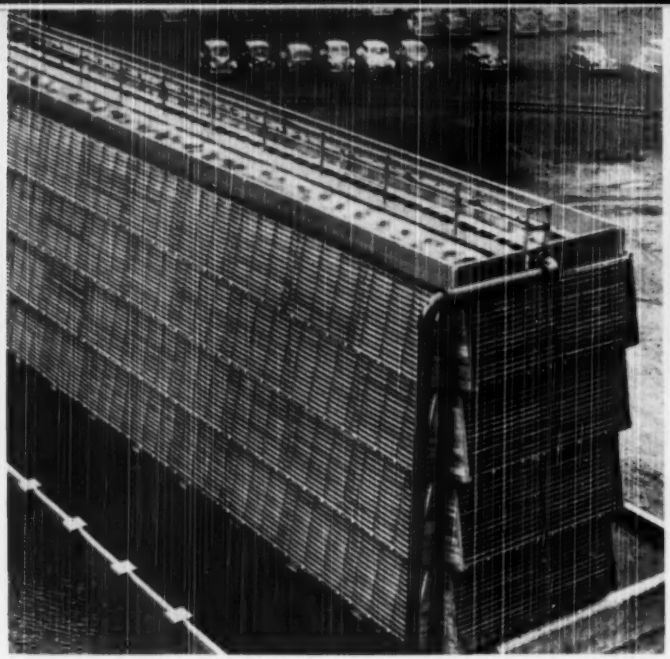
You'll notice another difference, too. The 1924 engine burned oil by air injection. Its 1949 counterpart uses mechanical injection. And it's designed to operate as either an oil-burning or dual-fuel engine. Williams and Chittendon are now converting the new unit to dual-fuel operation, and plan to convert the 1946 engine (No. 6) soon.

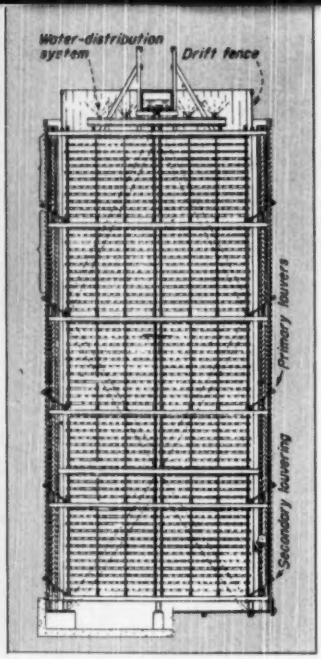
Taking a closer look at the 1949 unit, you'll see mechanical features now fully accepted for large 2-cycle engines—trunk pistons, direct-driven Roots-type scavenging blower, individual Bosch injection pumps for each of the nine cylinders. Each cylinder gets positive lubrication at six points, with the Manzel forced-feed lubricator synchronized to piston position. A Woodward IC governor controls speed. Engine is direct-connected to a 3000-kw GE 2400-volt alternator with a belt-driven exciter.

Auxiliaries. You'll also notice careful engineering of auxiliaries to insure reliable operation—an American automatic air filter on the intake, Burgess-Manning snubber on exhaust, Honan-Crane continuous-bypass lube-oil filter, and a Struthers-Wells shell-and-tube oil cooler. Engine is equipped with a motor-driven emergency lube-oil pump.

As you stroll back to your car, you'll see the Marley induced-draft tower that cools raw water for the common engine-cooling system. Jacket water circulates in a closed system, through a group of shell-and-tube heat exchangers. You'll also notice—you can't miss them—two 400,000-gal bulk-fuel storage tanks. Tank heaters make handling heavy fuel oil easy in cold weather (they have it in Missouri, too). Centrifuging conditions the fuel from the storage tanks before it goes into two 15,000-gal clean-oil tanks. At this point gravity takes over the supply to engine day tanks.

Before you leave, Herb Williams will tell you the new unit operated 74% of possible hours in the year after start-up, and no pistons were pulled.



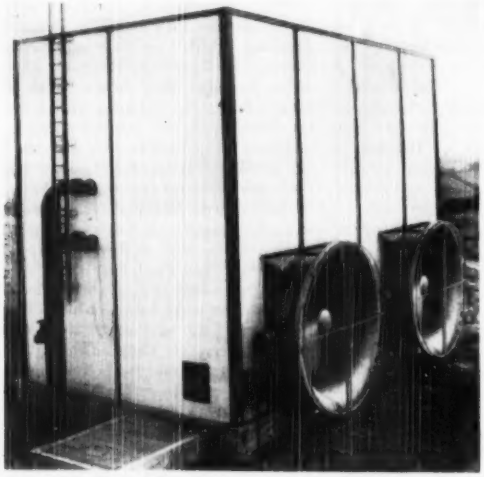


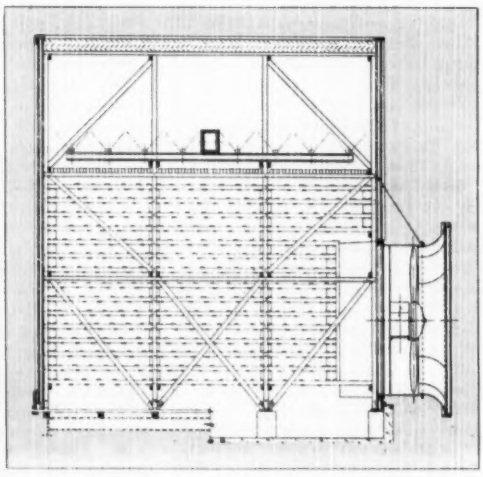
ATMOSPHERIC DECK TOWER consists of wood or steel framing and open horizontal latticework decks of wood. Hot water is distributed over upper part of structure by troughs, splash heads or nozzles and drops from deck to deck on way to basin

Tools for Saving, Cooling Water

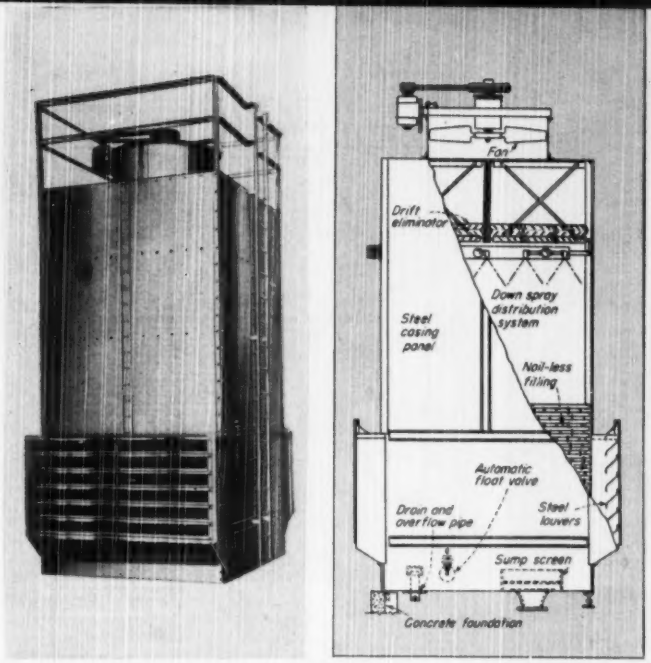
Cooling towers and dry coolers offer a wide variety of solutions to water-conservation problems. Here's a roundup of types and their characteristics

By **HOWARD E DEGLER**, *Technical Director, The Marley Co, Inc*





FORCED-DRAFT TOWER has fans mounted near ground level, on rigid foundation, and wood fill. While generally less advantageous than induced-draft towers, the forced-draft type offers advantages where corrosive water supply must be handled



MECHANICAL-DRAFT TOWERS, either induced (above) or forced (below, facing page) are independent of wind velocity, can be designed for more exacting performance

► INCREASING WATER SHORTNESS and its higher cost focus attention on ways of doing the same job with a smaller supply. Evaporative cooling, in which air does most of the work, proves an effective answer. Last month (April, pp 112, 113) we saw how this method works and took a look at the spray pond, one form of evaporative cooling.

That look revealed definite limitations —spray ponds are costly in space and dollars, relatively inefficient. Except under favorable conditions, they have largely been replaced by cooling towers and dry coolers. These units can be designed for greater compactness and efficiency, prove much more flexible in application. Let's cast an engineer's eye over types available and see how they fit our picture.

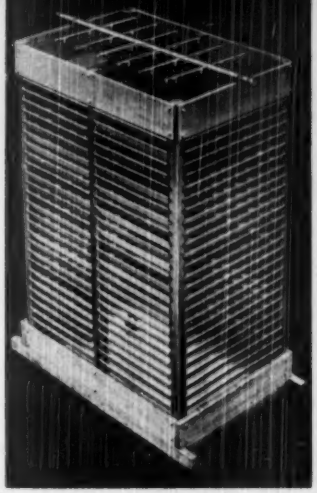
Spray-Filled Tower. Simplest of all is the *spray-filled natural-draft tower.* This is really a narrow spray pond (length twice width, or more) with elevated nozzles and a high louver fence. As usually built, nozzles spray downward. Distance from center of nozzle system to fence on either side is not more than half distance of nozzles above water basin. Heights range from 6 to 15 ft; total width of structure usually runs less than height. Loadings range from 0.6 to 1.5 gpm per sq ft of tower area. This means about one-fourth the area of an equivalent spray pond. Louvers are continuously wet, hence add to water surface exposed to cooling air. Such towers serve for cooling requirements of less than 30,000 Btu per minute. (See photo, dwg, above right.)

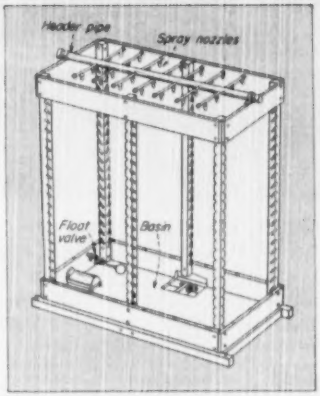
Atmospheric Deck Tower. Another variety of atmospheric tower (natural draft) is the *atmospheric deck tower.* It consists of a sturdy wood or steel frame, 20 to 50 ft high and 8 to 16 ft wide, carrying open horizontal latticework decks of wood at regular intervals from top to bottom. The hot water is distributed over upper part of structure by troughs, splash heads or nozzles, and drops from deck to deck on the way to the basin. Decks serve to arrest fall of water, break and re-break it to present most efficient cooling surface to the air. Latter passes through tower transverse to decks. Wooden decks also add to area of water surface exposed to air. But since they add to flow resistance, number and arrangement of decks must be based on test and experience. (See photo, facing page.)

Wide louvers (drift eliminators) attached to tower at regular intervals from top to bottom prevent water loss on leeward side. Louvers extend outward and upward at an angle of 45 to 50 deg. In most designs top edge of each louver extends above bottom edge of one above.

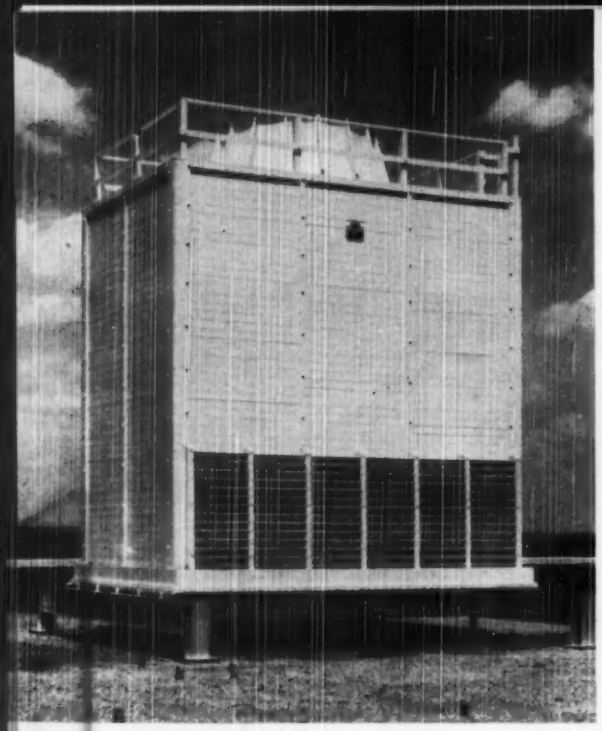
Deck-Tower Performance. Within limits, increasing length or height (or both) of a deck tower raises its efficiency by increasing area exposed to wind. In neither case is improvement directly proportional to the change made. Nor does a certain percentage change of one dimension make an equal gain in efficiency on two towers of different original lengths and heights. Since efficiency range varies through wide limits, it proves impractical to list data here on area needed for unit quantity of water. Efficiency gain from raising height comes at expense of additional pumping head and increased weight per unit area. Adding to either length or width increases area and foundation needed.

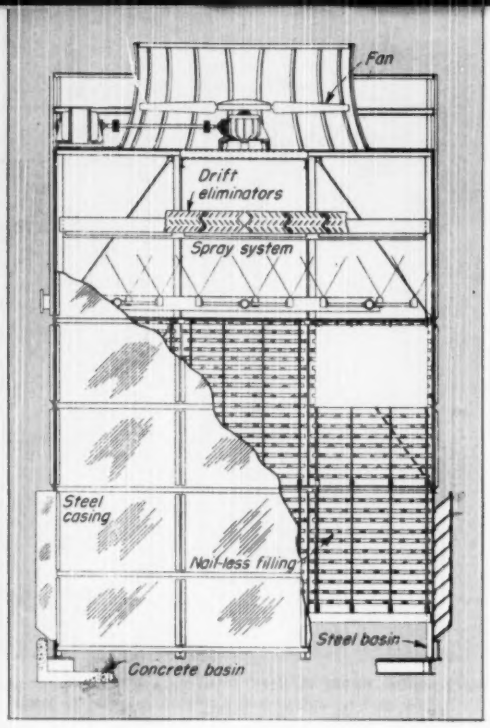
In a properly designed deck tower, drift runs considerably less than in a spray pond. Nevertheless, drift nuisance may prove considerable and for this reason deck towers may be considered unsuitable for downtown building roofs, locations adjacent to buildings or near expensive mechanical equipment in industrial plants. They must be in open areas, broadside to prevailing wind. They are inefficient with wind velocities





SPRAY-FILLED natural-draft tower simulates spray pond with high louver fence





INDUCED-DRAFT TOWER, of "conventional" counterflow design, has fan at top to provide vertical air movement across the filling. It discharges upward at a high velocity to prevent recirculation of moist air, which may cut performance by 20%

less than 3 mph and directions other than broadside. High pumping needs (up to 60-ft head) and total dependence on atmospheric caprice prove disadvantages. These towers are long and high for their width, hence must be securely anchored to prevent uplift or overturning during high winds.

Mechanical-Draft Towers. With dependable fan-produced air movement, towers can be made more compact and efficient. Such a *mechanical-draft tower* consists usually of a vertical shell (wood, metal, transite or masonry) in which water is distributed near the top and falls to a collecting basin in the bottom. Air is circulated from bottom to top (or sometimes horizontally) by forced- or induced-draft fans. Air passes counterflow or "crossflow" to water, and is thus in contact with hottest water just before leaving the tower. Hence a given quantity of air picks up more heat than the average equal quantity of air on natural-draft equipment.

Types of Filling. Inside of a mechanical-draft tower may be *spray filled*, with nozzles breaking water into droplets that fill entire inside of structure. Or tower may be packed with *wood filling* over which water cascades from top to bottom. Many units use a combination of these schemes.

In spray-filled towers, area presented to air is combined surface area of small drops present at any one time. Net free cross-sectional area of air spaces runs greater than that of a wood-filled tower for same gross area. This results in lower air velocities and longer time of contact between air and water in the same structure height. Before discharge to open atmosphere, exhaust air passes through a drift eliminator to remove entrained moisture.

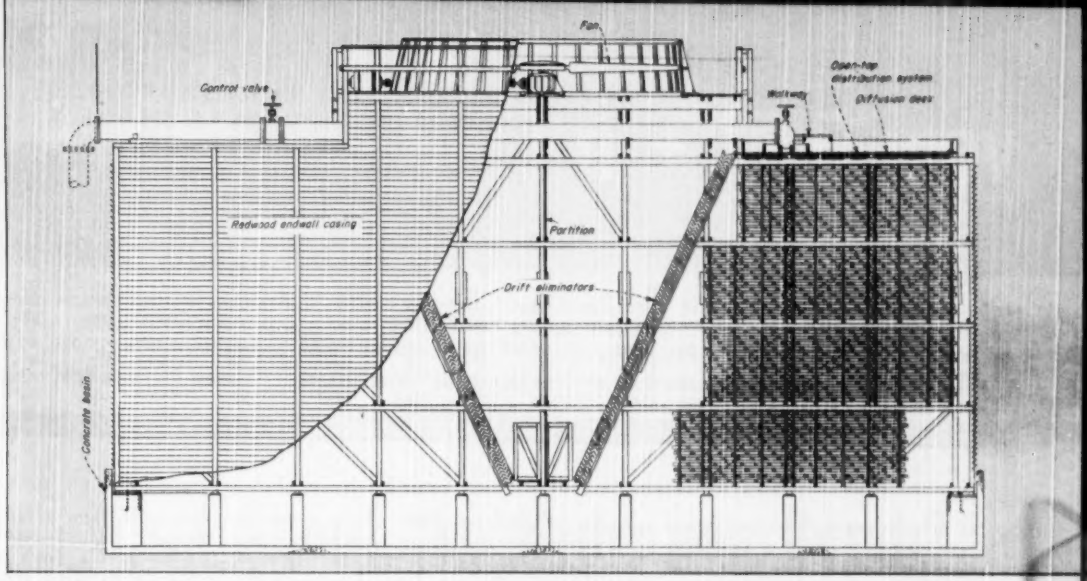
In wood-filled towers, lumber of various cross sections is laid horizontally across the space. Centers are kept as close, both horizontally and vertically, as possible without too greatly increasing resistance to air flow. Water may be distributed over top layer by: spray nozzles, troughs, splash heads, or evenly spaced nozzles located in the floor of an overhead open-type water-distribution basin. Water drops from piece to piece of the filling as it flows downward. As air moves upward (or across the filling, or in both directions) it passes the wetted surfaces. It repeatedly breaks up the falling drops and continuously provides new drop surfaces whose summed-up areas are several times those of the wood fill.

Mechanical-Draft Performance. Increasing amount of filling, height, area or air quantity of a mechanical-draft tower improves efficiency. More height boosts length of time air is in contact with water without seriously affecting fan power needed. But it does increase pumping head. Increasing area while holding fan power constant increases air quantity somewhat and boosts contact time because of lower velocity. In both cases, surface area of water in contact with air goes up.

Increasing air quantity cuts down time air is in contact with water but since more air is passing through, average differential between water temperature and air wet-bulb temperature is raised. This speeds up heat-transfer rate. Higher air quantities come only at the expense of greater fan power, which goes up roughly as the cube of air quantity. Air velocities through mechanical-draft towers vary from 250 to 400 fpm over gross structure area.

Since performance of mechanical-draft towers is independent of wind velocity, it becomes possible to design them to meet more exacting needs. They take less space and need less piping than atmospheric deck towers. Pumping head varies from 10 to 30 ft depending on design. Gain in over-all economy from colder water usually more than offsets additional initial and operating cost, compared to natural-draft towers.

Forced-Draft Towers. Towers designed for forced-draft prove suitable

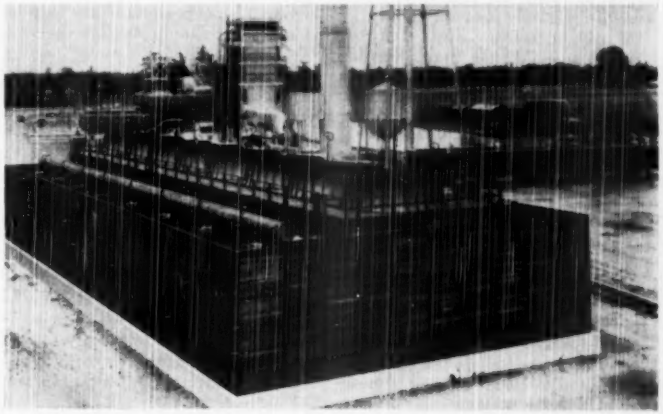


DOUBLE-FLOW induced-draft tower, as shown above and right, employs horizontal air flow, with fans centered along the top. Each fan draws air through two cells paired to a suction chamber partitioned midway below fan, and fitted with drift eliminators that turn air upward. These towers are built in large sizes for corrosive waters. Fan mounts near ground level on a rigid foundation and is easily accessible. Possible objection to forced-draft design lies in the fact that heated air leaves top of tower at low velocity. It may recirculate to fan inlet. This cuts performance, sometimes as much as 20%. During cold weather, recirculation may cause ice formation on adjacent buildings and equipment, as well as on fan ring. Fan breakage may result.

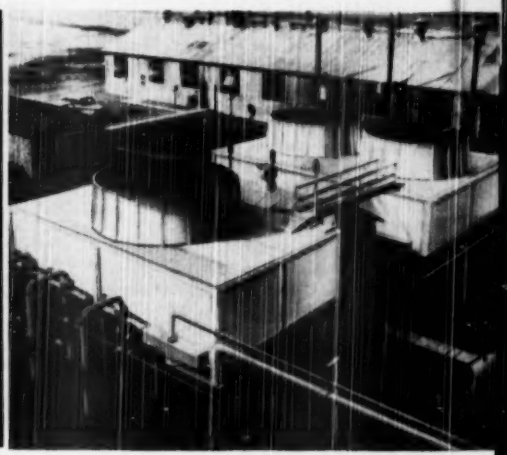
Fan size is considered limited to about 12 ft. This may mean more fans, motors, etc, for large towers than would be required for induced-draft design, where fans may run as large as 20 ft in diameter.

Induced-Draft Towers. The counterflow (conventional) type of induced-draft tower has fan at top to provide vertical air movement across the filling. It discharges upward at a high velocity to prevent recirculation. Another type (generally suited for small requirements) has the induced-draft fan in one end, for horizontal flow.

Double-flow towers (also called cross-flow) also have essentially horizontal air motion. Fans center along the top, each drawing air through two cells paired to a suction chamber. This is partitioned midway beneath the fan and fitted with drift eliminators that turn



DRY COOLERS, which are shown below, are essentially noncontact convection heat exchangers. Air is forced or induced over finned tubes carrying fluid for cooling



I—CHARACTERISTICS AND COSTS OF WATERCOOLING TOWERS FOR YEARS 1925 TO 1950
95-F HOT WATER (10-F RANGE)—85-F COLD WATER (10-F APPROACH)—75-F WET BULB

	1000 gpm (500 kw)				5000 gpm (3000 kw)				20,000 gpm (12,500 kw)			
Year	1925	1932	1941	1950	1925	1932	1941	1950	1925	1932	1941	1950
Base, ft	18x24	19x24	20x24	16x28	22x96	30x72	30x80	36x48	36x220	26x240	40x240	60x60
Height, ft	38	36	24	16	40	36	26	20	40	36	26	32
Area, sq ft	432	456	480	448	2112	2160	2400	1730	8420	8640	9600	3600
Fans, number	2	2	1	1	6	6	4	2	22	24	10	2
size	9	9	11	9	11	11	13	14	12	11	16	22
bhp, each	14.25	11.3	19	10	28.4	19.2	24	20	30	19.2	38.4	70
bhp, total	28.5	22.6	19	10	170.4	114.9	96	40	660	460.8	384	140
Weight, dry, lb	57,000	48,000	40,000	36,000	280,000	260,000	240,000	110,000	960,000	940,000	900,000	290,000
Pumping head, ft	25	25	20	11	27	27	20	14	28	28	20	26
Total cost, erected	$6000	$5500	$5300	$7000	$22,000	$20,000	$19,000	$18,500	$78,000	$71,000	$67,000	$58,000
Cost per kw	$12.0	$11.0	$10.6	$14.0	$7.3	$6.7	$6.3	$6.17	$6.3	$5.7	$5.4	$4.65

air upward toward fan outlet. Pumping head runs low, from 11 to 26 ft. Horizontal air movement, with drops falling across it, meets low resistance, makes possible relatively long air travel.

Water-distribution basin, which is open, is accessible for cleaning during operation. There is a close-spaced diffusion deck under the water basin for distribution to the wood filling. Loadings up to 10 gpm per sq ft are possible for steam-condenser service. A double-flow tower occupies less than one-twentieth the area of a spray pond for equivalent service.

Cooling-Tower Costs. Table I shows characteristics and costs for three representative sizes of cooling towers for the years 1925, 1932, 1941 and 1950. This reveals a quarter century of design improvements.

Careful study reveals that great reductions have been made in number and horsepower of fans, and pumping heads. Space needs are less today. The figures cannot show the gains made in elimination of drift loss, appearance, structural simplicity, flexibility of application and performance. Many of these advances have been translated into lower maintenance costs and greater safety. If allowance is made for today's lower-value dollar, it can be seen that these engineering advances have resulted in materially increased cooling-equipment values. An indication of the effect of the present inflationary situation can be gained from the fact that cooling-tower prices in 1943-45 were about 60% of today's.

Design Conditions. Lowest temperature to which water may be cooled in atmospheric equipment is temperature of adiabatic saturation, which is air's wet-bulb temperature. Performance is measured in terms of *approach* to this condition, when cooling water through some desired range. For example, in power-plant installations, cooling range may vary from 10 to 12 F when a spray pond is used, and from 12 to 17 F with a mechanical-draft tower. Approach to wet-bulb is not constant in any installation but increases as wet-bulb temperature increases.

Table II shows average noon, summer wet-bulb temperatures for typical cities in various parts of the U. S. Good practice calls for a design wet-bulb 2 F higher. For peak efficiency on capacity loads during hot weather, maximum design wet-bulb temperatures may be used as footnoted in Table II.

Dry Coolers. *Dry-cooling unit* is a device for cooling or condensing fluids by circulating them through finned tubes and forcing or inducing atmospheric air across the coil sections. It is thus basically a noncontact convection heat exchanger. For large units, commonest layout is with fan on top, discharging air upward and inducing air across horizontal coil bank below. In forced-draft design (see sketch on preceding page) fan discharges vertically upward across coil bank above. Small portable units have a vertical coil across which air flows horizontally.

Dry coolers may be used in preference to cooling towers for high-heat-level applications where temperature of fluid to be cooled starts above 140 F (referred to 100-F dry-bulb air temperature). They are also indicated where water is scarce, expensive or badly polluted. Portable feature may also prove desirable on some jobs.

Normally, cooling towers prove more economical, but as temperature of fluid to be cooled rises, cost of dry cooler decreases relative to that of a tower. Usually, a careful evaluation is needed to determine which type proves best for a given job.

II—AVERAGE NOON WET-BULB TEMPERATURES, THREE SUMMER MONTHS

State and city	F	State and city	F
Ala., Mobile	74	Neb., Omaha	70
Ariz., Phoenix	70	N. Y., New York	70
Ark., Little Rock	73	N. C., Raleigh	72
Calif., Los Angeles	65	Ohio, Cincinnati	71
Colo., Denver	60	Ohio, Cleveland	68
Fla., Miami	74	Okla., Tulsa	71
Ga., Atlanta	72	Ore., Portland	62
Ill., Chicago	70	Pa., Philadelphia	72
Ind., Indianapolis	71	Pa., Pittsburgh	69
Iowa, Des Moines	68	S. C., Charleston	73
La., New Orleans	75	Tenn., Knoxville	70
Md., Baltimore	73	Tenn., Memphis	73
Mass., Boston	68	Texas, Amarillo	66
Mich., Detroit	68	Texas, Dallas	72
Minn., St. Paul	68	Texas, El Paso	63
Miss., Jackson	74	Texas, Houston	73
Mo., St. Louis	72	Utah, Salt Lake City	60
Mo., Kansas City	70	Wis., Milwaukee	70

Maximum design wet-bulb temperatures average 5 to 7 F higher; these temperatures not exceeded more than 5% of hours in a normal summer, June to Sept., inclusive.

Translated, this formula reads, "One nucleus of tritium and one nucleus of deuterium fuse to form one nucleus of helium 4, plus one free neutron and 17.6 million electron volts of released energy." Each white circle represents a proton. Each black circle is a neutron. Tritium and deuterium are rare heavy isotopes of hydrogen. All forms of hydrogen have but one proton. The number of circles gives approximately the relative atomic weights

What About the Hydrogen Bomb?

Louis N Ridenour gives an informed, revealing answer in March *Scientific American* to everyone's question. Here's our adaptation reworded and condensed for power engineers. Noted physicist, Dean Ridenour heads the Graduate College, University of Illinois

► DURING THE FIRST WEEKS OF 1950, discussions of the so-called "hydrogen bomb" enlivened the national scene. On January 31 the President announced he had instructed the Atomic Energy Commission to work on the hydrogen super-bomb.

The public did not know then (nor now) the actual questions at issue. Indeed the matter became accessible to public discussion only through a careless reference to it made on a television broadcast by a senator who professes devotion to the principle of suppressing important information in the name of what he calls national security.

There are two basic ways to release atomic energy: (1) Split the nuclei of certain heavy atoms (so far only plutonium and uranium 235) into lighter, simpler atoms. (2) Not yet applied on earth (but constantly at work in the sun and other stars) is the combining of very light atoms to make heavier atoms. Energy of the sun and other stars, it is believed, comes from the fusion of ordinary hydrogen to form atoms of helium.

The sun-type reaction requires temperature measured in millions of degrees centigrade. It also requires much time. First requirement can now be met with a man-made device, the plutonium or uranium bomb. At the peak of an A-bomb explosion, core temperature may reach 50,000,000 deg C. The time requirement, however, cannot be met on earth. Such temperatures could not conceivably be maintained for more than a minute fraction of a second. Thus the sun's type of fusion reaction—ordinary hydrogen to helium—is probably not workable in a bomb, but a fusion reaction using other forms of hydrogen can proceed at a much faster and more feasible rate.

Operation of the existing fission (atom-splitting) bomb has been broadly outlined many times. Briefly, the exploding atoms of U235 or plutonium split other atoms in a chain reaction if a large enough ("critical") mass is gathered in one tight ball.

The fission bomb must contain more than the critical mass, but in separate pieces, each less than the critical. The bomb is detonated by bringing these parts together at great speed to create a supercritical mass. Extreme speed is essential because the explosion starts at once tearing the masses apart, thereby disassembling the critical mass and halting the reaction. That's why even the best bomb design can fission only a small fraction of the charge. The rest is wasted.

In practice, all this means that both the upper and lower sizes of a conventional atomic bomb are severely limited. You can't have a peanut-sized fission bomb. Nor can you make one with more than two or three times the critical mass of explosive.

No Limit to Fusion Bomb. There is no such limit to the charge or energy of a fusion bomb. No matter how large the mass of light atoms on hand to serve as explosive they cannot "fuse" without a primer able to create an igniting temperature measured in millions of degrees. Only conceivable primer is a complete fission bomb using U235 or plutonium.

As indicated, it seems unlikely a fusion bomb can be made from ordinary hydrogen—the common isotope having one proton and no neutrons. But the rare heavy hydrogen isotopes, deuterium and tritium (sketch, top of page), would seem suitable.

Deuterium is the form of hydrogen in "heavy water." Tritium in appreciable amounts has been made by the AEC in its huge facilities. As already stated, fusion-bomb designer would necessarily start with a complete fission bomb of U235 or plutonium as detonator. Material containing the suitable hydrogen isotopes would surround this primer, presumably in any quantity that could be produced and handled.

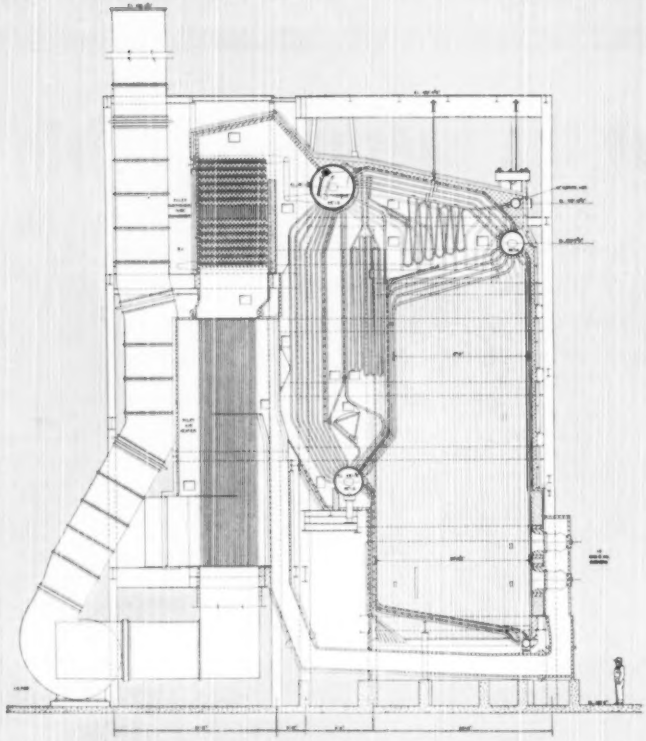
The core bomb would be set off as usual, and the resulting high temperature (in millions of degrees) would

TURN TO PAGE 110

4,540,000 lbs. of steam per hour

Eight different orders for Riley Units from Houston Lighting and Power Company . . . . .

To assure adequate electric power for the industries and people of Houston and South Texas, Houston Lighting and Power Company has had to tremendously expand their generating facilities. Riley was selected to furnish all of the steam generating units in this expansion program involving nine units with a total steam generating capacity of 4,540,000 pounds of steam per hour.



HOUSTON LIGHTING & POWER CO., West Junction Station
825,000 lbs./hr. Riley Steam Generating Unit
1050 lbs. Pressure—905°F. Steam Temperature
Ebasco Services, Inc., *Engineers*

RILEY at Houston

January 1938
GABLE STREET STATION
1—250,000 lbs./hr. 975 lbs. 910°F.

March 1940
GABLE STREET STATION
1—140,000 lbs./hr. 225 lbs. 500°F.

May 1941
WEST JUNCTION STATION
1—400,000 lbs./hr. 1000 lbs. 905°F.

June 1945
WEST JUNCTION STATION
1—400,000 lbs./hr. 1000 lbs. 905°F.

January 1947
GREENS BAYOU STATION
2—675,000 lbs./hr. 1050 lbs. 905°F.

June 1947
WEST JUNCTION STATION
1—825,000 lbs./hr. 1050 lbs. 905°F.

April 1948
GABLE STREET STATION
1—350,000 lbs./hr. 1000 lbs. 900°F.

October 1948
WEST JUNCTION STATION
1—825,000 lbs./hr. 1050 lbs. 905°F.

RILEY

STOKER CORPORATION, WORCESTER, MASS.

Boston · New York · Philadelphia · Washington · Buffalo · Pittsburgh · Cleveland · Detroit · Chicago
Cincinnati · Atlanta · New Orleans · Memphis · St. Louis · Kansas City · St. Paul · Tulsa · Houston
Denver · Salt Lake City · Los Angeles · Portland · Seattle

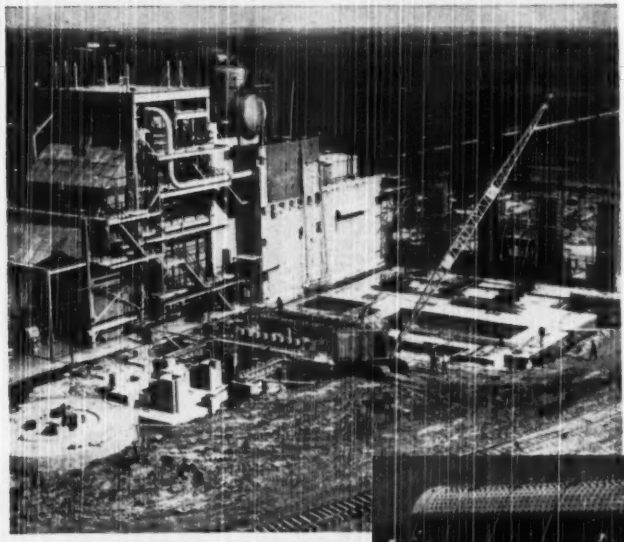
BOILERS · PULVERIZERS · BURNERS · STOKERS · SUPERHEATERS · FLUE GAS SCRUBBERS

from the 9 RILEY units at Houston

COMPARISON — Actual and predicted results
675,000 lbs./hr. Riley Unit—Greens Bayou Station

	Actual	Predicted
Temperature Feed Water	359.6	
Temperature Water to Boiler	452.2	452
Temperature Gas Leaving Airheater	314.3	370
Total Air Pressure	8.2	9.1
Total Draft Loss	6.9	7.7
Steam Temperature	905	905
Efficiency	84.97	82.1

Steam Output—643,200 lbs./hr.



View showing first 400,000 lbs./hr. Riley Unit at West Junction Station. Two 400,000 lbs./hr. and two 850,000 lbs./hr. Riley Units are now installed at this plant.

All of these public utilities have installed Riley Steam Generating Equipment:

PUBLIC SERVICE CO. OF INDIANA
- Dresser Station — 1—300,000 lbs./hr.
- Edwardsport Station — 3—400,000 lbs./hr.
- Noblesville Station — 3—300,000 lbs./hr.

NORTHERN VIRGINIA POWER CO.
- Riverton Station — 1—350,000 lbs./hr.

CENTRAL ILLINOIS LIGHT CO.
- R. S. Wallace Station — 1—600,000 lbs./hr.
- R. S. Wallace Station — 1—375,000 lbs./hr.
- R. S. Wallace Station — 3—300,000 lbs./hr.

ARKANSAS POWER & LIGHT CO.
- Cecil Lynch Station — 1—650,000 lbs./hr.

UTAH POWER & LIGHT CO.
- Orem Station — 1—450,000 lbs./hr.
- Jordan Station — 1—620,000 lbs./hr.

WORCESTER COUNTY ELECTRIC CO.
- Webster Street Station — 1—325,000 lbs./hr.

WEST PENN POWER CO.
- Milesburg Station — 2—210,000 lbs./hr.

INTERSTATE POWER CO.
- Lansing Station — 2—120,000 lbs./hr.
- Fox Lake Station — 2—120,000 lbs./hr.
- Clinton Station — 1—45,000 lbs./hr.

NEW ORLEANS PUBLIC SERVICE CO.
- Market Street Station — 1—330,000 lbs./hr.

IOWA-ILLINOIS GAS & ELECTRIC CO.
- Riverside Station — 3—250,000 lbs./hr.
- Cornwallis Station — 1—[illegible]

CITY OF LOS ANGELES
- Harbor Steam Station — 3—825,000 lbs./hr.
- Harbor Steam Station — 2—675,000 lbs./hr.

MISSISSIPPI POWER CO.
- Plant Eaton — 3—230,000 lbs./hr.

OTTER TAIL POWER CO.
- Kidder Station — 2—100,000 lbs./hr.
- Crookston Station — 2—75,000 lbs./hr.
- Devils Lake Station — 1—75,000 lbs./hr.
- Canby Station — 1—75,000 lbs./hr.

OHIO EDISON CO.
- Mad River Station — 1—250,000 lbs./hr.

SOUTH CAROLINA POWER CO.
- Plant Hagood — 2—230,000 lbs./hr.

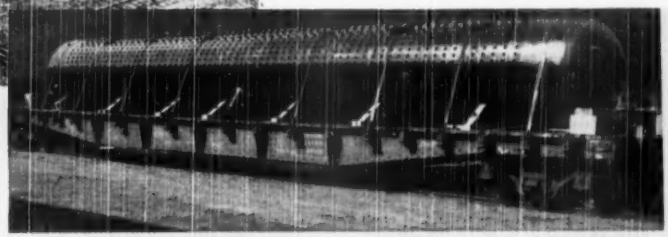
GULF POWER CO.
- Pensacola Station — 2—230,000 lbs./hr.

UNION ELECTRIC CO. OF MISSOURI
- Ashley Street Station — 2—285,000 lbs./hr.
- Ashley Street Station — 3—410,000 lbs./hr.

CENTRAL OHIO LIGHT & POWER CO.
- Woodcock Station — 1—120,000 lbs./hr.
- Woodcock Station — 1—90,000 lbs./hr.
- Woodcock Station — 2—60,000 lbs./hr.

PENNSYLVANIA ELECTRIC CO.
- Williamsburg Station — 1—300,000 lbs./hr.

CAROLINA POWER & LIGHT CO.
- Moncure Station — 2—330,000 lbs./hr.



Steam Drum for Riley Unit at West Junction, 66 in. dia., 55 ft. long, 3 $\frac{9}{32}$ in. thick

A survey of your Power Plant by a consulting engineer will possibly show ways of making surprisingly large savings in your power costs

COMPLETE STEAM GENERATING UNITS

. . . it will pay you to visit modern Riley Installations before purchasing Boiler or Fuel Burning Equipment

ECONOMIZERS · WATER-COOLED FURNACES · STEEL-CLAD INSULATED SETTINGS · AIR HEATERS

BLAST

Small circle is a mile radius of heavy blast destruction by Hiroshima-type bomb. H-bomb 1000 times as powerful would level buildings 10 miles away — outer circle. Bombs center on Manhattan Island, N. Y. ***Redrawn from April Scientific American***

FLASH

Flash-fatality radius expands more rapidly than blast-destruction radius as bomb gets bigger, so multiplying bomb power 1000 times extends flash fatalities from 4500 ft to 20 mi. Thus flash plus blast of a 1000-X superbomb could destroy largest city

then set off the fusion reaction, which would continue to live off its own heat.

When we speak of a fusion bomb a thousand times as powerful as a conventional bomb we merely quote one possible figure. It could equally well be 2, 7, 10 or 100 times, according to the designer's intention and skill.

To Sum Up. Here, then, are the technical conclusions about the fusion bomb:

1. It can be made.

2. There is no limit, in principle, to the size or energy of the fusion bomb, except it cannot be smaller than a conventional fission bomb. It may be many times bigger than a fission bomb, perhaps thousands of times bigger.

3. Unlike nuclear fission, which can be controlled for fast or slow reaction as desired, the fusion reaction can go only at uncontrollably high explosive temperatures. So it is good for bombs, and nothing else.

4. We are speaking of a special type of weapon, one appropriate only for destruction of very large targets. This weapon is clearly much more useful to the USSR than to the USA, for we have many suitable large targets while they have only one or two.

5. The fusion bomb is not a brand new possibility that has suddenly burst on men's minds. Physicists have known of this possibility for several years.

It is curious that the fusion bomb was proposed in terms of a reply to the Soviet achievement of the fission bomb, since this reply involves production of a weapon uniquely suited to destroy our own great cities.

Be that as it may, the decision to make the superbomb has been taken and, in our world of hotly nationalistic fear and jealousy, we must assume it is the right decision, militarily. Certainly a decision to forego making the bomb would not have persuaded the USSR to forego it, unless she saw that her own interest lay in that direction.

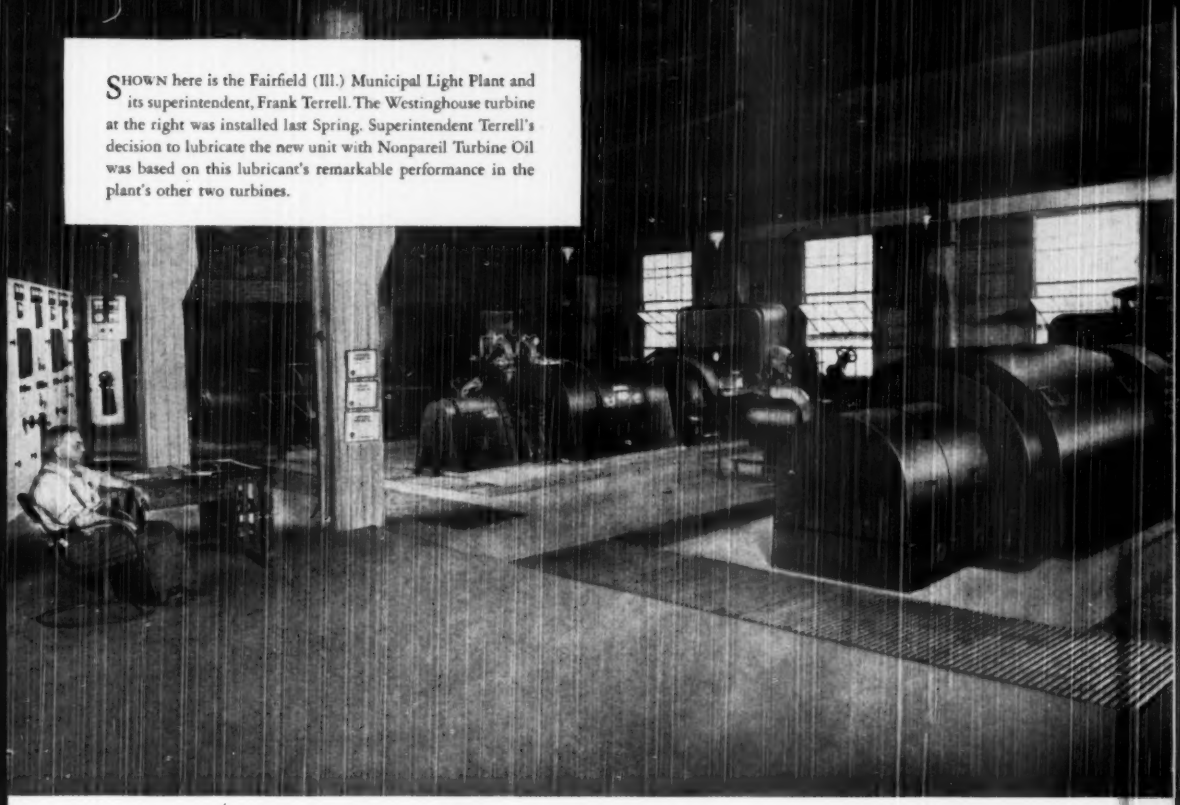
Secrecy Has Failed. We have surrounded the atomic-energy field with unusual "safeguards" to protect "national security," yet the practical effect is to cut off that field from the assistance of the majority of the nation's technical brains and facilities. The powers we have given AEC encroach on many of the principles basic to Western democracy. Yet it seems we have still failed to obtain from the Commission the efficiency and boldness of decision sometimes urged as the major benefit of totalitarianism. Our general security policy plainly bears re-examination.

Let's Face Reality. Of one thing we can be sure—the whole experience demonstrates once more the truth for which the outcome of World War II provided such compelling evidence—an informed democracy is the strongest and most durable political form. A government does not adequately protect its citizens by making decisions they can neither know about nor take part in. Almost certainly, we would be better off to treat the atomic-energy field like any other known part of our complicated technology, such as the steel or automotive industry.

Possibly the shock of the news about the superbomb may at last bring us face to face with the realities. We may appreciate the bankruptcy of our secrecy policy when we see how it excludes us from decisions vital to us without in any way hiding the discussion from potential enemies.

We may also see that an agreement for the control of atomic energy, or for limiting any other specific weapon, is not what we require for long-term safety. What we need is an international agreement amounting to the resolve of men not to kill other men. Yet even we are not ready to sign that one today.

Until all nations are ready to do so, the question of whether to make superbombs can have only one answer—and that answer has been given.



SHOWN here is the Fairfield (Ill.) Municipal Light Plant and its superintendent, Frank Terrell. The Westinghouse turbine at the right was installed last Spring. Superintendent Terrell's decision to lubricate the new unit with Nonpareil Turbine Oil was based on this lubricant's remarkable performance in the plant's other two turbines.

Here's minimum turbine-oil maintenance

CENTRIFUGING once a year is the only turbine-oil maintenance found necessary at the Fairfield Municipal Light Plant, Fairfield, Illinois. This practice has been followed ever since 1940, when Nonpareil Turbine Oil first went into the plant's new 1500-KW Westinghouse turbine. The same routine has been employed on a second Westinghouse unit of 2500 KW, installed in 1942.

During these 8 and 10 years of operation, the original fills of Nonpareil have not been removed either for treating or for replacing. Neutralization numbers have stayed below 0.08 mg KOH/gm. Oil systems have remained entirely clean.

Such lubricating economy and efficiency is not limited to 10- or 15-year records with Nonpareil Turbine Oil. Each fill of Nonpareil carries a written guarantee that it will remain below a neutralization number of 0.15 mg KOH/gm. *for the life of the turbine* it lubricates. 21-year service records of Nonpareil provide evidence of its ability to end acidity trouble and oil maintenance once and for all.

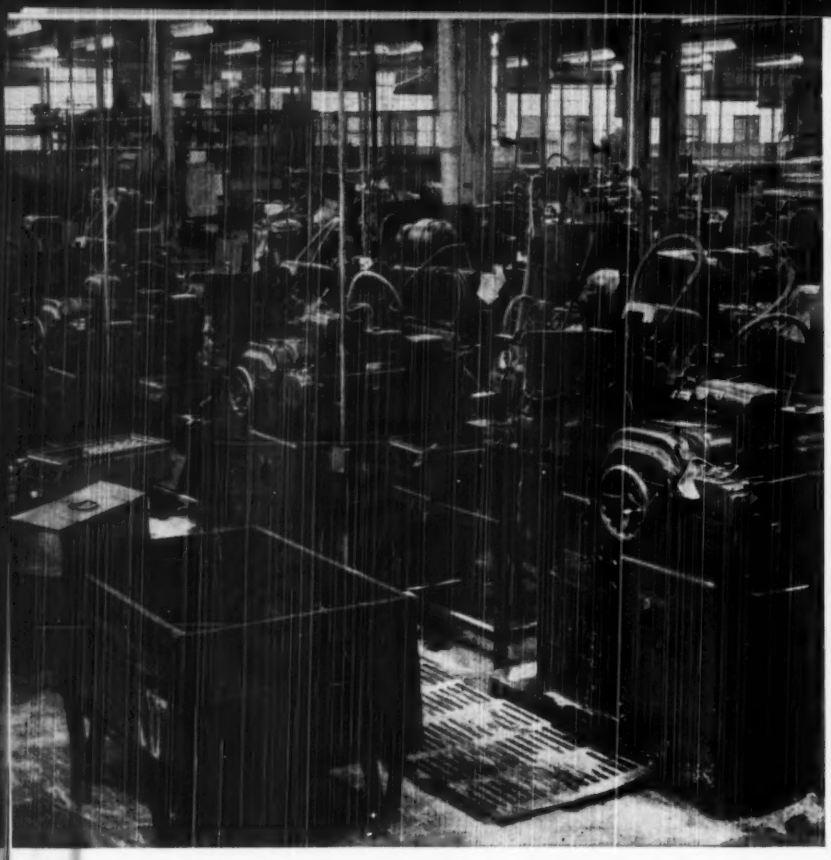
A Standard Oil Lubrication Engineer will be glad to supply you with actual case histories of utility operations in which Nonpareil Turbine Oil has reduced lubrication costs as much as 68%. Your letter will obtain the Engineer's services.

Write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

NONPAREIL
Turbine Oil

"Will outlast your turbine"

STANDARD OIL COMPANY (INDIANA) STANDARD



Eliminates three out of four hydraulic cleaning jobs . . .

● Once a month these Gage-Matic machines had to be shut down for cleaning of the hydraulic systems. Sticky valves and heavy deposits were a serious problem. The Stephens-Adamson Mfg. Co., Aurora, Illinois, asked a Standard Oil lubrication specialist to solve it.

He recommended using STANOIL Industrial Oil. This is a highly stable product containing an oxidation inhibitor and an anti-foam agent. *It proved to be exactly right for this application.* Valves now operate smoothly and efficiently. Contamination has been minimized. Cleaning of hydraulic systems is necessary now only at three-to-four month intervals.

These benefits are typical of those gained on a wide variety of jobs by STANOIL users. This multi-purpose oil is notable for long oil life and for clean, reliable lubrication of speed reducers, air compressors, and circulating systems. A Standard Oil lubrication specialist will help you take full advantage of STANOIL's versatility. This specialist is located within easy reach of your plant. How you can benefit by his on-the-spot lubrication service is explained at the right.

STANOIL
TRADE MARK
Industrial Oil

Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

What's YOUR problem?

● William Voegeli, of Standard Oil's Joliet, Illinois office, is the lubrication specialist who helped this customer solve a troublesome hydraulic oil problem. Standard's lubrication specialists are located throughout the Midwest. One of them is within easy reach of your plant. He offers you on-the-spot lubrication service that's backed by extensive experience and training in the use of modern lubricants and fuels. He can help you make important reductions in operating and maintenance costs.

Arrange, today, for a visit of a lubrication specialist by phoning or writing the nearest Standard Oil Company (Indiana) office. Ask him to give you actual performance data on these outstanding products:

STANOIL Industrial Oils—This multi-purpose line of oils provides cleaner operation of hydraulic units, supplies effective lubrication in air compressors, gear cases, and circulating systems. One or two grades can replace a wide variety of special oils and lubricants.

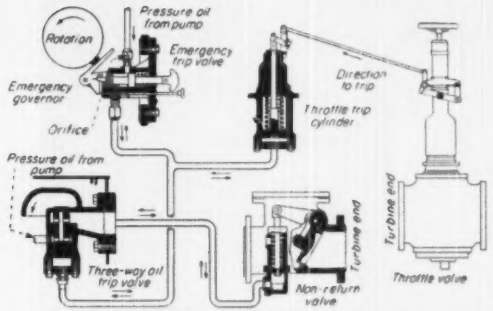
CALUMET Viscous Lubricants—These greases strongly resist washing and throw-off. Their superior wetting ability affords better coating of open gears and chains, better internal lubrication of wire rope.

STANORUST Rust Preventives—The eight grades of STANORUSTs form one of the most complete and effective lines of rust preventives on the market today. Each has been scientifically and specifically developed for its intended use. The grades range from a fingerprint remover to a heavy petrolatum that protects against corrosion for years under the most severe outdoor exposure.

STANDARD OIL COMPANY (INDIANA)

LETTERS FROM A TURBINE SPECIALIST—7*

By E W BURSTADT and C F BUCKLAND, *Turbine Division, General Electric Co*



ALL STEAM OPENINGS into turbine, including extraction points, must close immediately on accidental loss of load

PROTECT TURBINES AGAINST OVERSPEED

Dear Mr Specialist

The last time you were here we discussed the new 7500-kw noncondensing automatic-extraction turbine generator we plan to buy. In talking about so many things, I completely forgot to ask what provisions would keep the set from overspeeding. We might have trouble with our electrical system while there is a process-steam excess.

Give recommendations for this set, also general rules.

Very truly yours
ENGINEER

Dear Mr Engineer

Strange as it seems, complete protection of a turbine-generator against overspeed may be as much the responsibility of the customer as of the manufacturer.

When suddenly opening generator circuit breakers on electrical trouble, energy input to turbine rotor instantaneously exceeds its energy output. To prevent serious overspeeding, the turbine's normal speed governor must close the governing valves at once. Normally, the speed governor is powerful enough to keep the speed below the emergency overspeed governor setting upon sudden load loss. The latter governor provides a second line of defense by tripping the stop or throttle valve closed if the speed governor fails.

This overspeed protection is adequate for turbines having no openings in the shell. If a turbine has openings for steam extraction or admission, the extraction piping and associated equipment may cause possible overspeeding. Here the customer or his plant designer shares the responsibility of overspeed protection with the turbine designer.

To understand this, consider what happens when an extraction turbine suddenly loses load and governing valves close. Pressure in turbine shell drops at once to pressure at exhaust. At one instant steam was flowing out of the turbine into heater or process lines. Now, steam reverses and flows back into turbine, expanding through lower turbine wheels. Amount of power produced depends on quantity of steam, and water flashing into steam, which is stored in the system and can flow back into the turbine. Steam spaces of turbine, pipelines and heaters act as an accumulator feeding steam back into the turbine the minute the governing valves close. Extraction piping and heaters contain the greater part of accumulator volume. When stored steam can produce enough power to overspeed the turbine, steps must be taken to limit pipeline volume or control backflow.

To set safe limits of stored steam the turbine designer trys to: (a) preserve normal speed-governor guarantees (b) limit stresses in rotating parts to safe values in failure of normal speed and pressure governor controls.

To meet condition (a), designer makes *recommendation one*, limiting stored steam to a point above which rotor acceleration makes it impossible to meet the guarantees. To meet (b), he makes *recommendation two*, limiting stored steam to a point above which acceleration overstresses rotating parts. Valves placed in extraction and admission lines at a point that reduces pipeline volume, between valve and turbine, to specified values, limit the stored steam. The following show the valve type for particular cases.

Example 1: Condensing or noncondensing turbines with uncontrolled extraction openings piped to feedwater heaters or process lines.

a. If total stored steam does not exceed recommendation one, no valves are required.

b. If total stored steam does not exceed recommendation two, simple check valves with free-swinging disk, often called nonreturn valves, located in accordance with recommendation one are adequate. When steam-flow reverses, the swinging disk seats itself, halting steam flow into turbine.

c. When total stored steam exceeds recommendation two, a power-operated cylinder should be added to enough of the check valves to fulfill the needs. Power cylinder consists of a spring-loaded piston actuating the free-swinging disk by oil and air pressure. Emergency overspeed governor controls the pressure. When the overspeed governor functions it releases the pressure and spring-loaded piston seats disk.

d. When extraction openings tie into steady steam source, use in series free-swinging check valve with power cylinder and simple swing-check valve. If steam source supplies continuously 15% or more of zero-extraction full-load throttle flow, use in series two free-swinging check valves, each with power cylinders. Control one power cylinder by turbine's normal speed-governing system, other by emergency overspeed governor. Have valves agree with recommendation one.

Example 2: Condensing or noncondensing turbines with automatically-controlled extraction or admission openings.

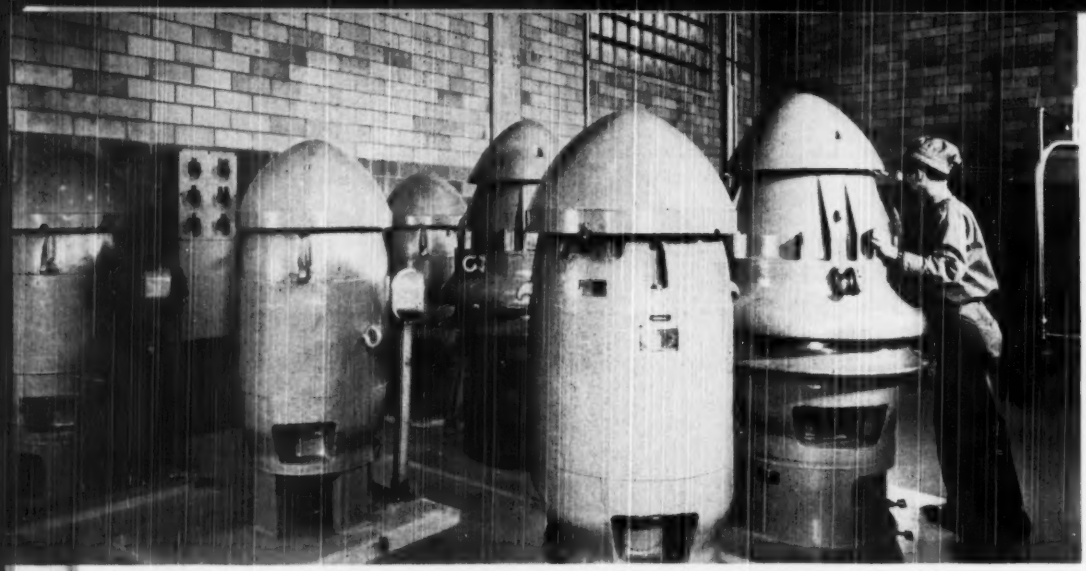
a. These turbines have control valves that can regulate steam flow into the turbine via shell openings. A free-swinging check with a power-cylinder for extraction lines and a stop valve for admission lines placed according to recommendation two is adequate. Overspeed governor should trip the stop valve on an admission turbine.

The turbine designer gives the plant designer the maximum allowable capacity of stored steam in Btu terms for each unit. He may suggest the Btu per cu ft for each extraction opening. These can be readily converted into pipeline volume to fix the number and location of check valves.

These valves must be in working order at all times.

Sincerely yours
TURBINE SPECIALIST

* If you're wondering why this is No. 7, following No. 10 in April, it's because we overlooked 7 in sequence. This is actually letter 10; No. 11 will run next month.



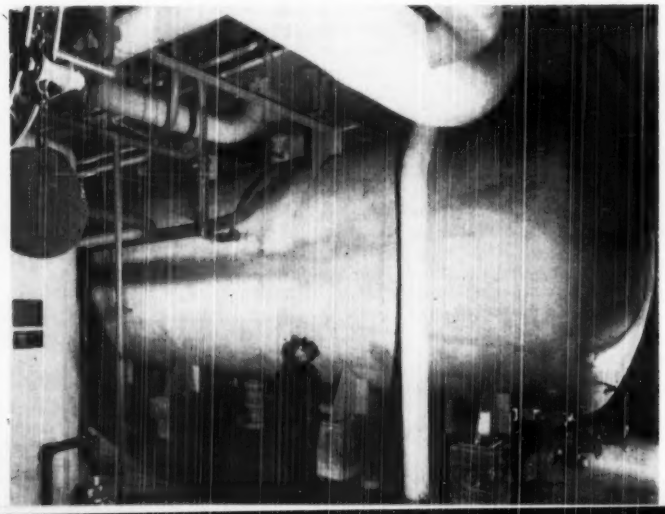
BARREL-TYPE motor-driven boiler-feed pumps, have 500,000 lb-per-hr capacity at 50-psig suction, 1875-psig discharge pressure. Drum runs at 1400 psig; superheater outlet, 1350 psi. Exit steam is 925 F, controlled from half to full load

Yesterday's Planning Provides Water

Engineers at the Mitchell Power Station, West Penn Power Co, got the jump on erection and put their water-preparation system in operation ahead of the main units. Here's how they provided filling water for the boilers and boiled them out*

By **W. L. THOMPSON**, *Chemist, Mitchell Station*

DEAERATING HEATER contains 2200 cu ft of water storage, about 2 min supply. Designed for 50 psi, to produce water containing not more than 0.005 ppm oxygen



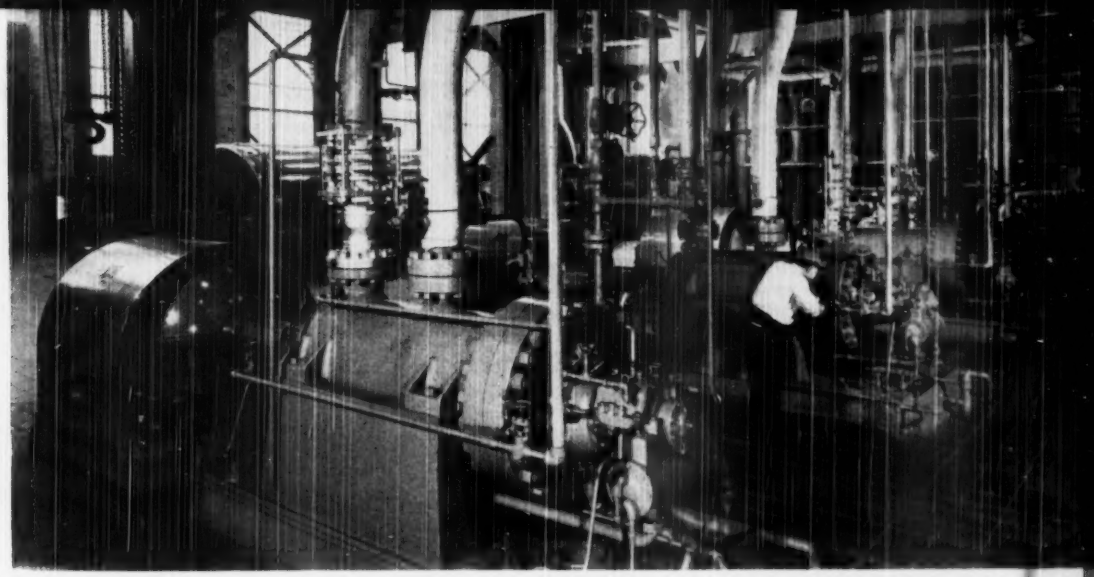
► MITCHELL POWER STATION of the West Penn Power Co is 25 miles south of Pittsburgh at Courtney, Pa. on the Monongahela River. One of the first problems was to select a water source for boiler feed and sanitary purposes. Comparison between the cost of purchasing city water and filtering river water showed it was more advantageous to construct a filter plant.

River water is pumped to the treating plant where it enters the mixing flume of two Spaulding precipitators through a control valve. Chlorine for breakpoint chlorination is fed downstream from this control valve, but before the water enters the mixing flume. Changes in flow rate to the precipitator are made from a selector valve (manual sender) on a local control panel.

Precipitators. Each precipitator is rated 600 gpm and is large enough to supply full plant needs. Units are guaranteed to reduce effluent turbidity to 10 ppm or less, provided influent turbidity does not exceed 2500 ppm.

Constant level of the floc or sludge blanket in each precipitator is maintained automatically by passing a water sample from the desired level through a photoelectric turbidity detector, which closes a contact when sludge

* Abstract of a paper delivered at the Tenth Annual Water Conference, Oct. 17, 1949, Engineers' Society of Western Pennsylvania, Pittsburgh, Pa.



RAW-WATER PUMPS for high- and low-pressure services deliver water to heat exchangers and screen washers where water is not reclaimable and to treating plant. Where clean cooling water is needed, run-around system circulates filtered water

For Today's Boiler Washing, Startup

obstructs the light beam to photo cell.

Back flushing, which consists of cleaning out the blowoff line with clarified water from the filter-pump discharge, is controlled by a time switch and operates on a 20-min cycle. An interrupting relay prevents blowoff and back flushing at the same time.

A Bailey flowmeter, in the precipitator intake, records and integrates the quantity of raw water being treated. Electrical contacts on the meter integrator close each time a given quantity of water enters the precipitator. This energizes the motors on the two precipitator chemical-feed-control units, which then operate to add the amount of chemicals required. Two 1000-gal chemical-feed tanks have enough capacity for 24-hr operation at rated capacity.

Coagulation. Chemicals are fed to the prechlorinated water in the mixing flume to promote coagulation in the precipitator. Caustic is used to increase water pH to that required by the coagulant being used (alum or Ferrisul). Ferrisul is used only when a satisfactory floc cannot be produced with alum, a condition occurring when there has been little rain to dilute the river's acid, iron and manganese content.

Because of the high pH (8.5-9.5) required in the precipitator when using Ferrisul, acid will be added after filtration to lower the pH for brass-valve protection. Valves in the treated-water lines between precipitator and filtered-water storage tanks have stainless-steel trim for protection against high pH. To date, satisfactory operation has been obtained with alum.

A sampling connection, in the mixing chamber of each precipitator, is piped to a pH cell that regulates caustic feed to the precipitator. In winter, when river water was below 45 F, considerable difficulty was experienced with erratic readings from the glass electrode. It seemed to be caused by high resistance developing at the glass electrode. After several changes in electrode design, daily cleaning was resorted to and toward early spring, with water temperatures still in the 40-50 F range, results were satisfactory.

During periods of low river flow, when acidity rises (pH decreases), a lime solution is added at the raw-water-pump inlet to raise the pH to 5.0 or 6.0. This lime pretreatment helps reduce the amount of caustic required.

Chlorination. Chlorine is applied to the water at:

1. Precipitator influent. (Dosage is manually adjusted for breakpoint chlorination to remove taste and odor, and aid in oxidation of compounds, with a slight excess residual to help remove ammonia.) Maximum machine capacity is 75 lb per 24 hr.

2. Postchlorination of filter effluent. (Dosage is manually adjusted to maintain 0.5 ppm residual, an amount that does not attack Zeo-Karb in the softener.) Maximum capacity of machine is 20 lb per 24 hr.

3. Chlorination of softener effluent. (Dosage is automatically adjusted to maintain about 2.0 ppm residual.) Chlorination to maintain a high residual at this point is experimental because it is not certain any ammonia will remain in the evaporator feed after prechlorination to breakpoint. As this is the supply for domestic water, some chlorination is necessary and a residual is maintained in the clearwell of the gravity filter. Maximum machine capacity is 15 lb per 24 hr.

Automatic controls on the chlorinators will stop: (1) Prechlorination through low-flow contact in flowmeter when both precipitators are shut down (2) postchlorination of filter effluent through interlocks in the filter-control circuit during reconditioning of any filter (3) chlorine feed to evaporator by a pressure switch in discharge line when the evaporator feed pump is not operating.

Pressure Filters. Water is pumped from the settled-water basins of the precipitators to four 200-gpm Anthrafilt pressure filters to provide evaporator feedwater with minimum silica content. A level controller on the settled-water

basin controls amount of water pumped to the pressure filters. Except for starting the reconditioning cycle, which is done by pushbutton, entire back-washing operation is automatic. Effluent water from the filters flows to two 60,000-gal concrete storage tanks. From here the water is pumped to the filtered-water service system and softeners.

Softening. Two Zeo-Karb Na softeners, each rated 65 gpm normal and 170 gpm maximum, have completely automatic control for regeneration. Coarse salt is stored in the two wet-storage basins large enough to hold carload lots. Softened water is chlorinated and used for either evaporator feed or supply for the gravity filters.

Gravity Filter. Domestic water supply is filtered according to regulations of the Pennsylvania State Health Dept. Water is admitted to the top of the gravity-filter bed from the evaporator feed line through a float-operated control valve, which maintains a constant water level over the filter bed. Controls prevent (1) water level being drawn down below top of filter bed, (2) clear-well being emptied, as well as stop flow when clearwell is full.

Acid Feeder. As previously explained, acid is needed only when Ferrisul is being used in precipitators when the water pH will be above 8.6. Desired pH in the filtered-water system is about 7.0. Strong sulfuric acid is siphoned from an acid carboy into the acid-measuring tank from where it flows to the strong-acid tank. Here a helical feeder picks it up and discharges it into the dilute-acid tank.

Feed rate is controlled by contacts in a Bailey flowmeter, the same as for the alum feeder. Dilute acid flows by gravity from the dilute-acid tank to the acid mixing chamber in the filtered-water line just ahead of the storage tanks.

Dry Lime Feeder. During periods of low river flow, when acidity is high, a lime solution is added at the inlet of the first stage of each raw-water pump to maintain incoming water between pH 5.0 and 6.0. Lime slurry from the discharge header of the slurry pump is fed to each raw-water pump through a manually controlled valve, which discharges into a sight funnel.

Water-treatment plant was placed in service Nov 6, 1948. As the Administration Building, which contained the testing laboratory, was only partly completed, all chemical tests were made in the treating plant. Automatic equipment on the precipitator was not available so it was operated manually. Before water was admitted to the precipitator, HTH (dry calcium hypochlorite) was thoroughly distributed throughout the basin.

To facilitate floc formation, a concentrated charge of alum and caustic soda was put in the mixing chamber. Water from the precipitator was discharged to the drain until a sludge blanket formed, which took about 36 hr. We experienced some trouble in controlling the sludge-blanket because it tended to carry over into the settled-water basin. To correct this condition we (1) decreased flush-back water pressure and (2) changed the direction of agitator rotation. This caused the floc to move upward between the agitators instead of downward.

Jar flocculation tests, run to determine the proper pH for optimum blanket formation and minimum chemical dosage, indicated 7.2 pH and an alum dosage of 1½ gr per gal would give best results. While the precipi-

TABLE I—COMPARISON OF MONONGAHELA RIVER WATER, CITY WATER AND WELL WATER, JANUARY 31, 1947

Constituents	Monongahela River	Well water	Treated city water
P alkalinity, ppm	0	0	7
M O alkalinity, ppm	10	198	31
Methyl red alkalinity, ppm	3	100	18
Hardness, ppm	80	300	80
Free CO_2, ppm	24	153	0
pH	5.4	7.5	8.7
Conductivity, mmhos	280	906	215
Appearance	Muddy	Clear	Clear

TABLE II—ANALYSIS OF MONONGAHELA RIVER WATER, FILTERED WATER AND SOFTENED WATER, APRIL 12, 1949

Constituents	Monongahela River	Filtered water	Softened water
Analysis No.	M-1	M-2	M-3
pH	6.3	6.9	6.8
P alkalinity, ppm	–14	–3	–5
M O alkalinity, ppm	10	15	20
Methyl red alkalinity, ppm	–1	10	15
Hardness	160	160	10
Conductivity, mmhos	305	355	360
Total solids, ppm	234	231	180
Silica, SiO_2, ppm	6.5	3.1	4.1
Fe_2O_3 — Al_2O_3, ppm	0.6	0.3	0.2
Calcium, ppm	35.0	17.0	0.5
Magnesium, ppm	6.4	0.4	0.3
Sodium, ppm	27.0	49.0	53.0
Chlorides, ppm	15.0	12.0	14.0
Sulfates, ppm	137.0	140.0	96.0
Bicarbonates, ppm	12.0	18.0	24.0

TABLE III—WATER-ANALYSIS RESULTS OF BOILING OUT NO. 1 BOILER

Date	Sample No.	Time taken	Sample location	Total alkalinity, Equivalent	Total hydroxide, Equivalent	Ether extraction, ppm
11/21/48	1	2:20 pm	East wall	22.5	15.1	—
	2	10:30	Drum	24.7	16.8	—
	3	10:45	East wall	20.2	14.0	—
11/22/48	6	2:50	Drum	22.7	16.5	—
	7	5:20	East wall	15.5	11.4	46
	8	5:23	South wall	20.4	14.6	—
11/23/48	22	5:30 am	East wall	25.7	20.2	76
	23		South wall	19.8	16.9	—
	25	5:40	North wall	24.7	19.3	—
	26	5:50	Drum	23.4	19.0	—
11/24/48	73	9:00	East wall	15.7	13.4	—
	74	9:00	South side	16.5	13.1	—
	75	9:00	West side	17.4	14.7	—
	76	9:00	North side	16.8	13.9	—
	77	9:00	Drum	15.7	13.7	10

TABLE IV—CONDUCTIVITY AND SILICA CONTENT OF SATURATED STEAM FROM NO. 1 BOILER AND CONDENSATE FROM NO. 2 DISTILLED-WATER TANK

Date	No. 1 boiler, saturated steam		No. 2 distilled-water tank	
	SiO_2, ppm	Conductance, micromhos	SiO_2, ppm	Conductance, micromhos
12/13/48	0	13.4		4.24
14	0	7.40	0	21.0
15	—	4.95	0	13.9
16	1	3.65	1	5.40
17	1	3.50	1	10.00
18	0	2.65	0	3.90
20	1	5.70	1	9.50
21	1	3.26	1	7.27
22	—	2.02	1	5.39
23	—	1.14	0	5.22
24	—	1.56	0	5.68
27	—	1.40	1	6.46
28	0	6.97	0	5.61
29	0	1.70	0	5.10
30	0	1.45	0	6.05
31	0	1.00	0	5.90
1/3/49	0	3.10	1	3.55
4	0	1.55	0	3.40
5	0	1.75	0	4.65
6	0	3.60	1	4.20
7	0	1.70	0	3.82
10	0	1.50	0	4.05
11	0	2.65	0	5.15
12	0	2.00	0	3.75

TABLE V—NO. 1 BOILER-WATER ANALYSIS OF DRUM SAMPLE, FIRST THIRTY DAYS

Date	Total alkalinity, equivalent	Total hydroxide, equivalent	PO_4	Silica as SiO_2	SO_3	Conductance, micromhos	pH
12/10/48	2.3	1.1	4	49	—	2500	—
11	2.7	2.0	4	47	—	2850	—
12	2.0	1.2	—	43	—	3300	—
13	1.8	1.1	—	40	—	2950	—
14	0.8	0.6	4	28	—	1670	—
15	0.5	0.4	0	22	—	1436	—
16	1.1	0.9	0	24	—	1532	—
18	2.9	2.1	0	20	—	1415	—
20	3.9	3.6	4	22	—	2200	—
21	3.0	2.9	6	20	—	1714	—
22	1.5	1.4	10	21	—	891	—
23	1.3	1.0	11	20	2	435	—
24	1.0	0.7	7	19	0	395	—
28	2.1	1.7	14	8	8	454	11.0
29	1.4	1.3	12	9	1	395	10.9
30	1.1	0.7	10	8	2	255	10.7
31	0.6	0.5	2	10	1	155	10.4
1/3/49	0.7	0.5	16	22	3	259	10.5
4	0.8	0.6	11	12	1	225	10.8
5	0.7	0.5	7	8	1	135	10.2
6	0.5	0.3	6	9	2	190	10.5
7	0.8	0.7	17	7	3	280	10.7
10	0.7	0.6	18	7	7	350	10.6
11	1.0	0.9	19	7	6	410	10.8
12	1.1	1.0	16	7	4	380	10.8

tators were running on manual control, numerous chemical tests had to be made to regulate the operation. After the precipitators were delivering satisfactory water, two pressure filters were thoroughly washed with settled-basin water from the precipitators and then placed in service. After thoroughly distributing calcium hypochlorite in the two 60,000-gal concrete filtered-water storage tanks they were filled with filtered water and drained to remove all debris.

Storage tanks were again filled with filtered water and the procedure for boiling out No. 1 boiler was set up. Table II shows an analysis of Monongahela River water, filtered water and softened water. Iron and aluminum content decreased from 0.6 ppm in the river water to 0.2 ppm in the softened water. Calcium content from 35.0 to 0.5 ppm.

Boiler Cleaning. No. 1 boiler is a Babcock and Wilcox unit rated at 500,000 lb per hr at 1325-psi gage and 925-F total steam temperature. Boiling out, started at 2:45 am, Nov 21, 1948, and finished at 12:30 pm, Nov 24, 1948, required a total of 81 hr.

Boiler was filled with about 265,000 lb of filtered water and a mixture of 300 lb trisodium phosphate and 100 lb sodium hydroxide added. Chemicals and water were mixed in a barrel and placed in the boiler drum with buckets. Phosphate formed as an absorbent for grease. Makeup for boiling was taken from filtered-water storage and pumped to the deaerator by an evaporator feed pump. Water was then pumped from the deaerator to the economizer inlet with a boiler feed pump. The boiler was heated by gas. As far as possible, Babcock and Wilcox recommendations were observed: (1) not to exceed 100-F temperature rise per hr and (2) to maintain not more than 50-F difference from top and bottom of the drum.

Primary inlet, primary outlet and secondary inlet superheater drain valves were opened one turn. Vent to the roof from the drain manifold was open. Time to bring boiler from 0 to 50 psi was 12 hr; from 50 to 500 psi, 21 hr. Time boiler was held at 500 psi, 33 hr. Time to drop pressure from 500 psi to extinguishing of burners, 15 hr. Time for temperature of drum bottom to drop from 296 to 123 F when boiler draining was started, 12 hr.

Blowdowns. First blowdown was made 38½ hr after lighting burners. Blowdowns at 500 psi, 32; at 500-300 psi while reducing pressure (every 2 hr), 24. Total blowdowns during boiling out, 56. About ¾ in. of water (equivalent to 900 lb) was blown from gage glass per wall blown. Water used during boiling out was 319,700 lb. Blowdowns used 50,400 lb or about 15%. Blowdown analyses are shown in Table III.

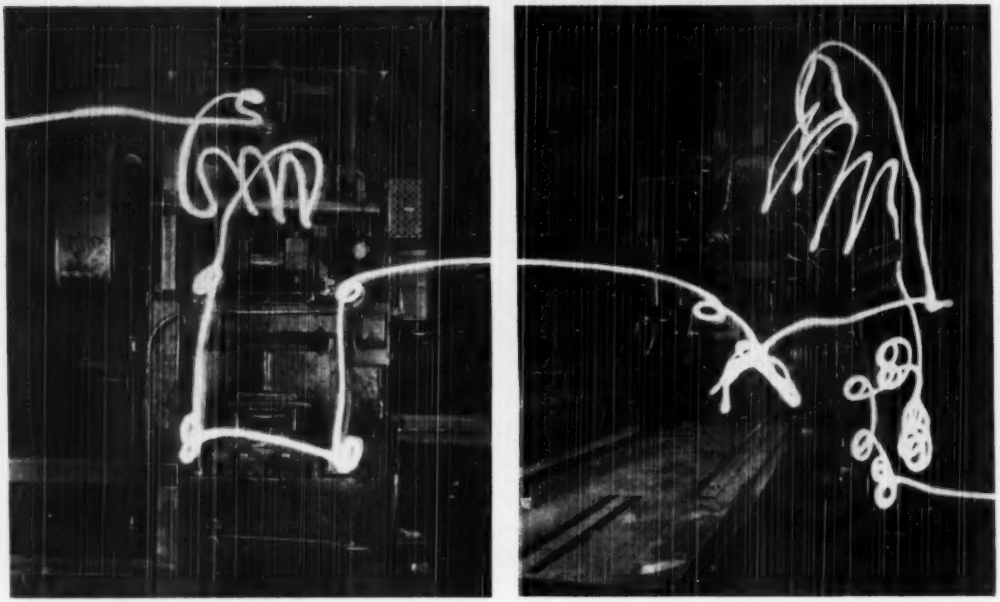
Chemicals. In addition to the original chemical dose, 60 lb trisodium phosphate and 25 lb sodium hydroxide were added after 24-hr boiling out from barrels discharging into the suction of the boiler fill pump.

Instruments and controls for boiler operation were:

1. Induced-draft fan dampers on hand control.
2. Forced-draft vanes and dampers on hand control.
3. Temporary connections for economizer inlet pressure, drum pressure, and superheater outlet.

(*Continued on page* 158)

TORTUOUS ROUTE OF OILER WITH HAND OILCAN INCREASES THE ACCIDENT POSSIBILITY



OILER'S TRAIL as he covered 62 lubrication points is traced in part by wiggly white line. Lad with an oilcan had a flashlight strapped to his wrist and his route around two sides of the machine was then recorded on film in time exposures*

Making Lubrication Hazard-Free . . .

And doing a better job to boot calls for extension-pipe or centralized-lube system, says Walter E Montgomery of Canada

► SAFETY ENGINEERS have for many years realized the lowly oiler has one of the most hazardous jobs in the plant. He is the lone wolf of industry. His job takes him to remote places seldom traveled by others and exposes him to severe hazards of moving machinery, etc. An oiler's rounds involve climbing and gymnastics that a monkey can best duplicate, and even he needs a tail. If you doubt this follow the path outlined in above photos.

Lube-Fitting Extension. Remember that many bearings require attention at least once a shift. That means the oiler has to climb a ladder, give the grease cups a few turns, and then climb down with greasy hands. We have been well aware of this problem and made tests some years back to see how far the old grease cup could push grease through a ¼- and ⅜-in. pipe. The aim here was to keep the oiler on the floor. Temperature proved a stopgap and 3 feet was the practical limit for a grease-cup extension.

Today the picture is different. With present water-free greases and pressure fittings we have made pipe installations to bearings over 30 ft away. And sub-zero weather is no longer a serious factor. In fact, bearings are now being lubricated where they were conveniently forgotten in the past. Our maintenance records prove this beyond doubt. And where cold weather is extreme, a 50% increase in pipe size is recommended.

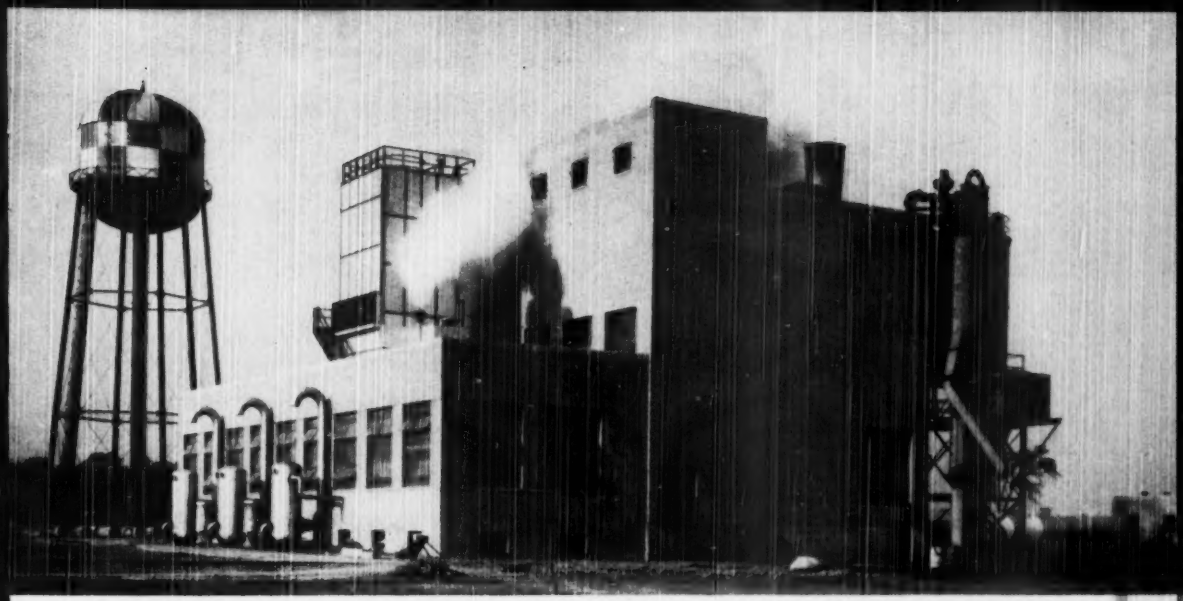
Every bearing grease-pipe extension saves the oiler over 250 round trips each year. If this remote-control-type accident-free system is installed on only 100 bearings you save the oiler 25,000 ladder trips annually. On top of that you have added assurance that the bearings are receiving required attention.

Centralized Lubrication. One of the most important advantages of a central lube system (at least from our viewpoint) is the absolute safety of application that permits proper lubrication while machinery is in motion along with eliminating the personal safety hazard. On top of that there's the matter of *downtime* elimination.

We may define a central lube system as one having a common lubrication supply with a feed line running to each bearing to lubricate. Then at timed intervals, a measured amount of lubricant is forced out of the lube-storage tank to each of the many bearing spots —a saving of time and the oiler's hide.

While safety is being increased, costs are being lowered with the central lube idea. A close estimate is that savings in grease alone amount to 50 to 75% of total lubrication required. In addition to the safety and economy angle there's an all-important third benefit and that is assurance that all bearings are getting adequate lubrication at proper time.

*Photo by William Vandivert for Fortune Magazine



POWER SERVICES usually have their beginnings in the power plant. New Chevrolet Cleveland Division of General Motors uses this scheme. To the left is a 300,000-gallon water-storage tank—a reservoir for plant needs supplied ordinarily by city-water mains. Steam for both process and building heating comes from four boilers housed here. Compressed air for various plant uses and controls originates here. All electricity is purchased from the local public utility

NEW PLANT has 1,380,000 sq ft floor area; electrical load, 21,500 kva; uses 150,000 gal water, about 300,000 lb steam per hr; has about 176 unit heaters, 77 summer- and 29 winter-supply fans, 168 summer exhaust fans

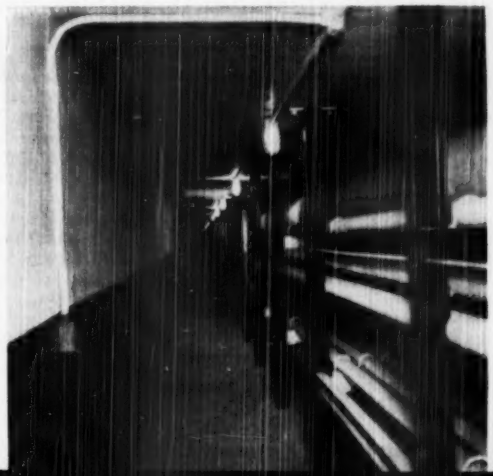
SERVICE TUNNEL connects powerhouse to plant 490 ft away. This tunnel carries two steam-supply lines, one 175-psi, other 30-psi; condensate-return line, 125-psi compressed-air supply line, and 6 process oil lines

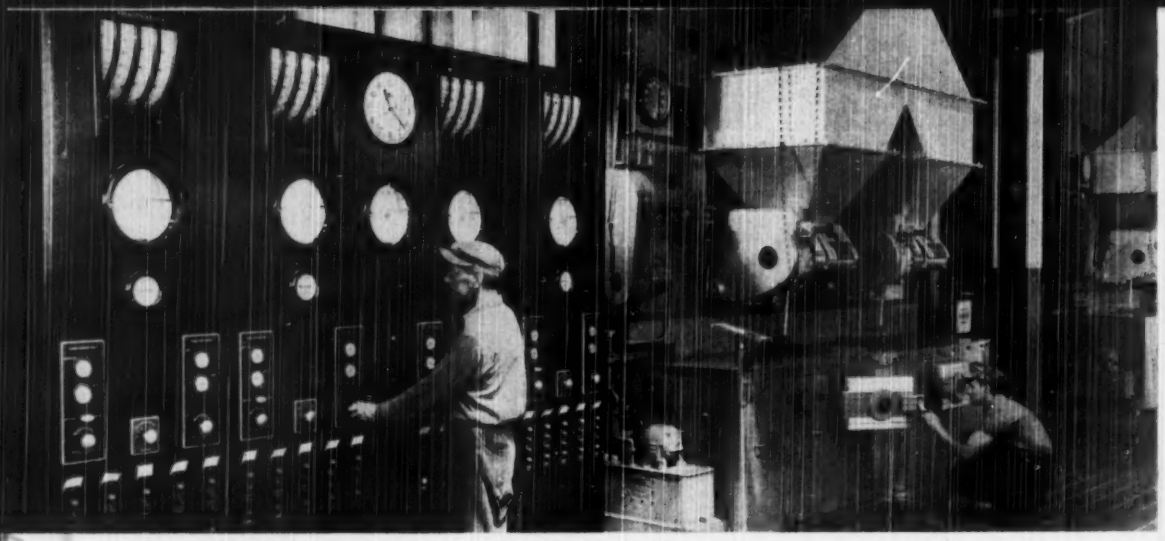
How Power Services Help Auto Maker

► INDUSTRIAL PLANTS, going into operation or in the design stage, feature complete, well thought-out and integrated power services. A good example is the new Chevrolet Division, General Motors Co plant at Parma, Ohio.

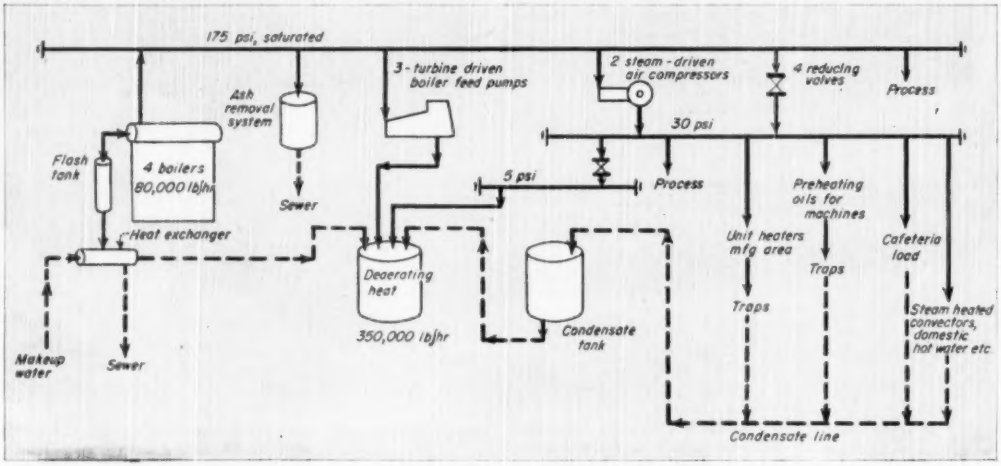
On a 355-acre tract, Chevrolet has put up a building of 1,380,000-sq-ft floor area, housing a single manufacturing floor with a two-story office and cafeteria section in the

TURN TO PAGE 118





STEAM SUPPLY is generated by four 80,000-lb-per-hr spreader-stoker-fired boilers. They deliver 175-psi steam to main header, in flow diagram below. Selection of spreader stokers permits fairly wide fuel flexibility, gives firing system with good load-swing characteristics. Actual number of boilers on line at given time depends on load requirements. A good portion of this load is the building-heating one and the supply of various service needs



FLOW DIAGRAM pictures steam distribution for process, heating and equipment drives. Major 175-psi steam users in powerhouse are ash-removal system, three turbine-driven boiler feed pumps, and two steam-driven air compressors. Most steam consumption comes off the 30-psi header. But the quantities of steam to handle indicated definite savings in generating steam at a higher pressure, and then use of reducing valves close to the load centers

front. Away from the manufacturing plant proper is the powerhouse.

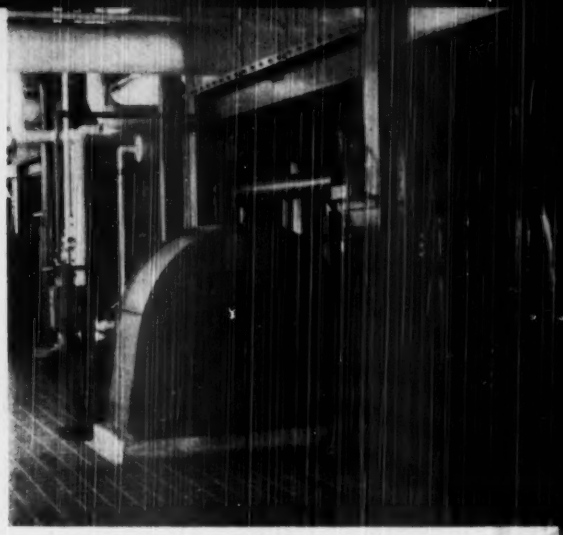
Manufacturing area requires all the usual power services—electricity, steam, water, compressed air, building heating, zone air conditioning. Electrical load amounts to 21,500 kva. Lighting alone accounts for 4000, and welding 3000 kva. Energy for this connected kva load comes from the lines of the Cleveland Electric Illuminating Co. Power cables from the substation are fed underground into the plant. They are then connected to four overhead transformer stations, spotted at load centers throughout the manufacturing area.

Power Services. Water needs are supplied by city water. Two 850-gpm booster pumps deliver water to an elevated 300,000-gal storage tank. The 300,000 gal act as a reservoir—150,000 for plant use and 150,000 for fire protection. In addition, there are two ground suction tanks of 150,000 gal each, to which 1500-gpm fire pumps are connected to supplement the elevated storage tank.

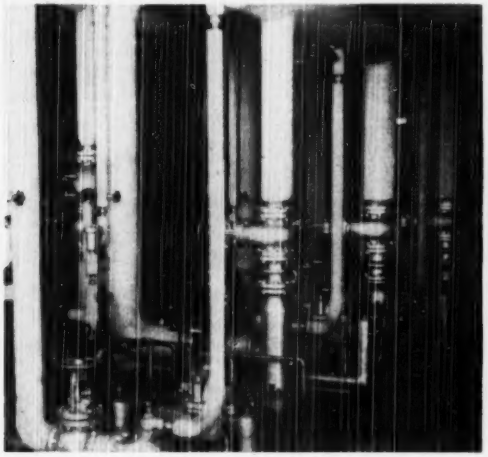
Compressed air originates in the powerhouse. There three 2700-cfm air compressors, two steam-driven and the third motor-driven, deliver air at 125 psi through a service tunnel to the plant 490 ft away. In this tunnel are (1) two steam-supply lines, one at 175 psi and the other at 30 psi (2) a condensate-return line (3) six process oil lines (4) compressed-air supply line.

Steam for process and building-heating purposes comes from four 80,000-lb-per-hr spreader-stoker-fired boilers. They generate steam at 175 psi and deliver it to a main header. Fed by

COAL SUPPLY for the battery of boilers on facing page comes into the plant on cars, goes from there to storage or by way of a coal elevator to the conveyor belt above. This belt then delivers the coal to storage bins



AIR SUPPLY for boilers is delivered by forced-draft fans. Induced-draft fans above remove gas, discharge it through stacks to atmosphere. Both sets of fans produce regulated overfire air draft with good combustion



BOILER WATER gets up to boilers through above steam-turbine-driven pumps. Steam selection as driving medium is an attempt to produce a good heat balance throughout boiler load range. Exhaust goes to the deaerator

WATER TREATMENT involves feeding prescribed chemical treatment in controlled amount to boilers on line, at rate that varies with units' steaming rate. Exact chemical treatment differs with water-analysis changes

this header in the powerhouse itself are three boiler feed pumps, the two steam-driven air compressors mentioned above and one 175-30-psi reducing valve. The 175-psi steam line continues to the manufacturing area for process service, and to supply steam for three 175-30-psi reducing valves for building heating.

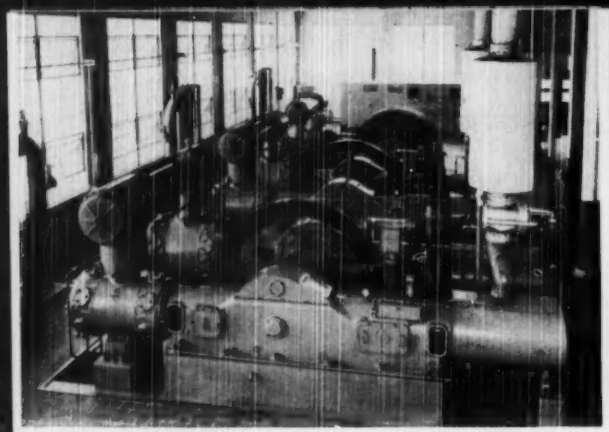
Exhaust from the boiler feed pumps goes to the 350,000-lb-per-hr deaerator to raise the temperature of the boiler feedwater. The steam-driven air compressors exhaust to the 30-psi header and, together with the four reducing valves, furnish all the steam at this pressure level.

The 30-psi line serves a large share of the steam load. Coming off the line in the power plant in addition to heating units is one reducing valve, 30-5 psi, which delivers steam to the deaerating feedwater heater. It serves as a supplement to the boiler feed-pump exhaust and makes up whatever additional steam is needed for maintaining feedwater temperature.

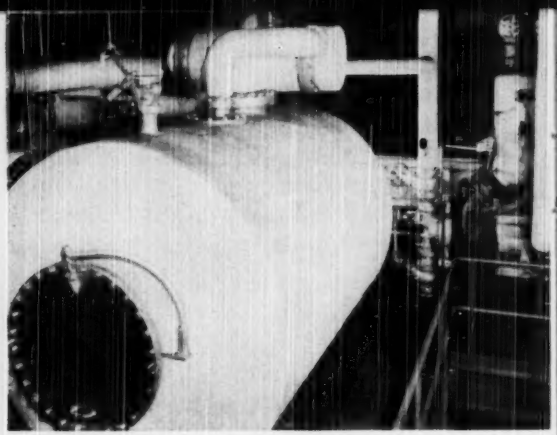
The lubricating- and machine-oil storage tanks in the tank farm near the power plant draw steam at 30 psi for closed steam-heating coils. These coils preheat the oil, and steam is trapped back to condensate lines for return to the boiler room.

Out in the manufacturing plant this 30-psi header feeds (1) process equipment (2) unit heaters in the manufacturing area (3) cafeteria load (4) steam-heated coils for washroom hand dryers, hot water for office convector-type radiators, and fan rooms.

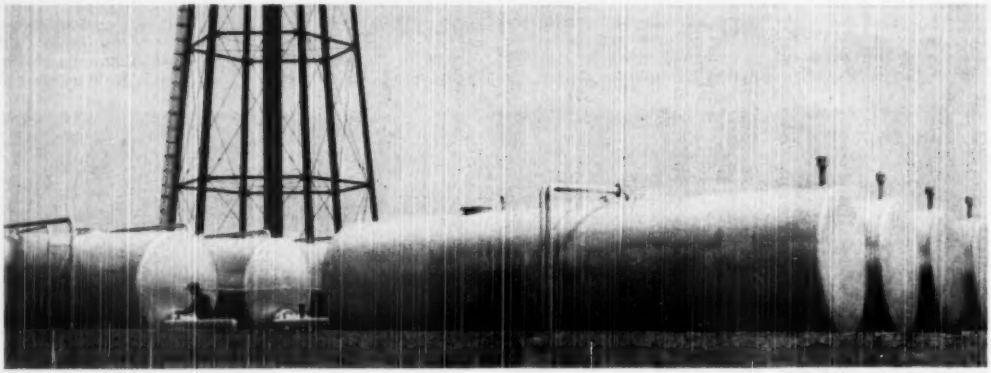
With the exception of process-steam users all others trap the condensate and



COMPRESSED AIR is an increasingly useful industrial tool. Application may be direct in many processes, or indirect in pneumatic-control devices. Three 2700-cfm air compressors furnish this plant's needs



DEAERATING HEATER receives all condensate return, makeup water, exhaust steam from boiler feed-pump turbines and any steam needed from 5-psi header to hold temperature above the boiling point of water



OIL-TANK FARM stores lube and machine oil for many machines throughout the plant. The tanks draw steam from the nearby powerhouse at 30 psi and feed it through closed steam-heating coils. They, in turn, are meant to preheat the oil to the point where it can be handled easily and flow properly for its production needs. The steam leaving the heating coils is trapped back to condensate lines and returned eventually to the deaerator above

discharge to a condensate-return line. This line goes back through the service tunnel to a condensate-storage tank. From there, water is returned to the boiler cycle and the deaerating feedwater heater.

Water Treatment. Raw or city water undergoes no feedwater treatment. Water in the boiler cycle, however, does have internal boiler-water treatment and a continuous blowdown system.

Heating System. Heating the 1,380,000 sq ft of the manufacturing plant—most of it of one-story construction and part of that under a high bay—poses a problem. Its scope is indicated by the very numbers of the fans and heaters throughout the plant. There are a total of 450 unit heaters, summer- and winter-supply fans, and summer exhaust fans. Of this total 176 are unit heaters, 77 summer-supply fans, 29 winter-supply, and 168 summer exhaust fans. Equipment is built to handle up to 5 air changes per hr if desired.

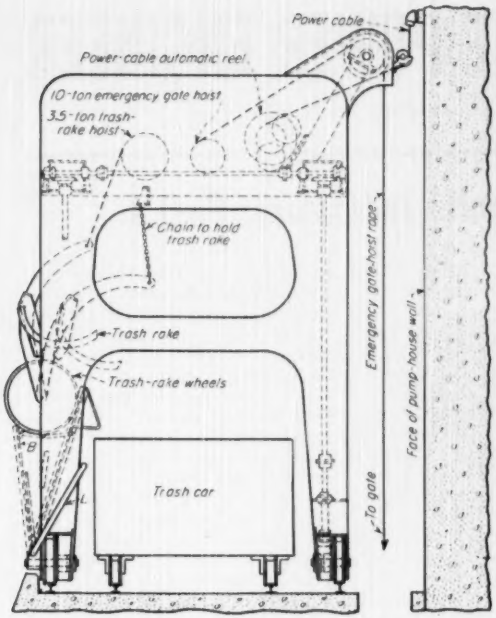
All unit heaters are vertical or ceiling-mounted centrifugal-fan designs. Those in the high-bay area revolve, to give a more even distribution of heated air. Selection of overhead heating units gives a heat source with transfer surface, piping and returns, completely away from the floor-level working space.

Office Heating. The 2-floor office section employs a split system of heating and air conditioning. Hot-water-supplied convectors furnish "skin-heating" needs. Spotted across the second floor above the office area, four fan rooms supply heated air to the different zones. Only one, Fan Room No. 2, has complete air-conditioning facilities.

Hot water for the convectors moves in a closed cycle. The necessary heating is performed by steam coils in central hot-water-storage tanks. This steam comes from the 30-psi supply; its condensate is trapped and returned to the boiler room.

Fan rooms have inlet louvers to admit outside fresh air. Air filters and steam coils are built into the fan-intake ductwork after the return-air duct connections. Fan Room No. 2 has a 25-ton refrigerating compressor. This compressor provides cooling-coil service in the air ductwork for its zone.

False ceilings are laid over the first floor of the office. They provide the space for the supply ducts. Remaining space, not taken up by supply ducts, acts as a return plenum. Exhauster fans in the return plenum pull air out and exhaust it to the plant manufacturing area. The quantity so exhausted depends on the amount of fresh air admitted through the intake louvers of the fan rooms.



DUMPING THE TRASH. When the rake with its trash load has been raised to its top position, debris is dumped into car

TRASH-RACK RAKE. On apron wall above the racks, the rake runs on two wheels, operated by two ropes powered by crane

Power Rake Cleans Pump's Trash Racks

To remove mass of trash on racks of six-billion-gal-a-day plant, rake is run by gantry crane that handles head gates

By H B McDERMID
Cincinnati, Ohio

► U.S. CORPS OF ENGINEERS has built a barrier dam in Cincinnati, near the mouth of Mill Creek, to keep Ohio River flood water out of the industrial district along the creek. While the Ohio is in flood, gates are closed in the dam, and six one-billion-gpd pumps raise all creek flow over it. This water carries large quantities of debris that lodge on pump-intake racks.

Fender Wall. A fender wall upstream from the plant keeps large debris from the racks. This wall diverts heavier material into the main channel while the racks catch what will not go through the pumps. A mechanical rake with curved teeth, operated by a motor-driven gantry crane, keeps the racks clean.

Rake and Crane. This 10-ft-wide rake rides on wheels, 2 ft, 9 in. in diameter with 8-in. face. Face of wheels is stepped so their edges ride on a pair of rack bars, and center section goes between as a guide.

Crane has two hoists. One, a 3.5-ton unit, has a 57-ft lift, is powered by a 2-speed, 3-hp, 600- and 1800-rpm motor, to hoist rake at 10 ft per min and lower it at 30. An emergency 10-ton gate hoist has a 46-ft lift, raises gates at 3 ft per min and at 9, is powered by same size and type motor as the rake hoist. A 5-hp 1200-rpm motor propels the crane on its track.

Cleaning Racks. When the hoist lowers the rake down the racks, its curved teeth slide over the trash. On the up trip, the rake, properly positioned by its two wheels, picks up trash. When the rake is raised to top position, the operator, or a limit switch, stops the hoist. Then with lever *L*, operator moves a pair of steel channel stop bars out behind the rake wheels, while the hoist's pull holds the rake's teeth in position to retain trash load before dumping.

As operator slacks off on the hoist ropes, rake wheels ride back against bars *B*, and stop. Further slackening of hoist ropes allows rake to tip forward to spill its load in the trash car. This car runs on a narrow-gage track between the crane's legs, along the dam top. When load is dumped, operator raises the rake until it clears the stop bars. They are pulled back to form a track for the rake, ready for another lower-and-hoist cycle.

Crane is designed not only to operate the trash rack but also to handle the head gates behind the racks. These gates close off water to the pumps if it is necessary to inspect them. When this is done, the trash-rake is hoisted to top position, held there by chains as shown, while the hoist ropes are unhooked so crane can lift or lower the head gates.

Handling Head Gates. Flexible cable brings power to the hoist through a stationary outlet in the plant's wall, at midpoint of hoist travel. As hoist travels along the track about 100 ft either side of the outlet, cable pays out or reels in automatically.

ELECTRONICS FOR THE POWER ENGINEER

By F A ANNETT, *Associate Editor*

25—Electronic Smoke-Density Indicators: Part 1

► SMOKE-DENSITY INDICATORS and recorders were one of the first applications of electronic tubes to boiler operation. First developed as smoke detectors, these instruments have a range and sensitivity that reads fine haze differences in stack gases, indicating small changes in combustion quality. So they are now more correctly called haze or combustion meters. They consist of three parts: (1) indicator unit with or without a recorder, placed at any convenient place in the boiler room for easy observation (2) light unit installed on side of stack or breeching in such a way that it directs a beam on (3) photoelectric unit on opposite side of gas stream.

Smoke and Haze Gages. Indicating meters are of two general designs: smoke gage and haze gage. A smoke gage has a scale graduated from zero to No. 5 Ringelmann, or from zero to 100% smoke. A smoke density of 100% corresponds to No. 5 Ringelmann. Often the scale has both Ringelmann and percent smoke graduations.

Best combustion conditions exist when stack haze has a density of about No. 1 Ringelmann. So the operating range of chief interest is between zero and No. 2 Ringelmann. This is the range covered by a haze-gage scale. It is graduated on an arbitrary scale with zero at the center and 100 at each end. Zero on the scale corresponds to No. 1 Ringelmann, to which the gage's needle points when stack-gas density corresponds to best combustion conditions.

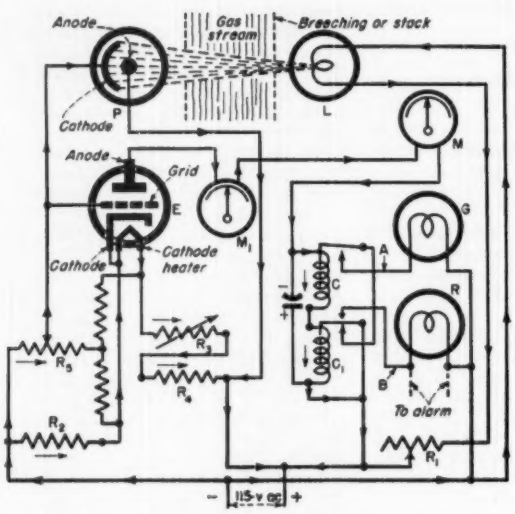
If stack-gas density becomes too light, pointer swings toward 100 on right. When haze is too heavy, needle swings toward 100 on left. A red lamp lights automatically when haze is too dense and a white or green lamp lights when haze is too light. By using only the first two divisions of the Ringelmann scale the haze gage can be made more sensitive than the smoke-density gage.

Smoke-Density Recorders. Two types of recorders are also used: operation and continuous. On the operation recorder, as long as the stack-haze density remains within the best combustion range, the pen traces a circle. When either of the pen's magnets is energized by the smoke-density indicator, pen swings to left or right of its normal path to show the stack haze is too dense or too light. This record does not show how dense or how light the stack haze is, but only that it has been outside the desired operating range. As many as eight pens may be used in one recorder.

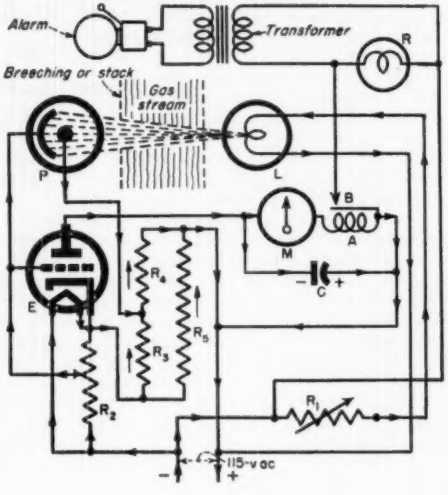
When a continuous smoke-density record is required, any one of several continuous recorders may be used. These are calibrated to record smoke density, on a chart graduated to 100% smoke, Ringelmann numbers, or both.

Haze-Indicator Operation. Fig. 1

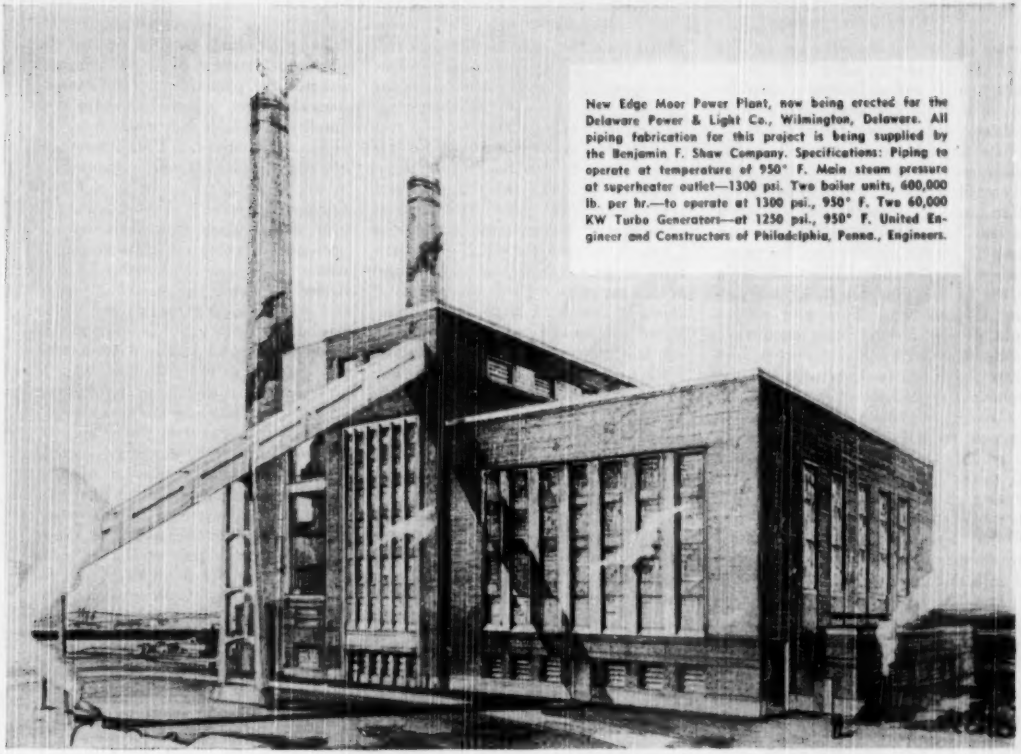
Simplified Diagrams of Two Electronic Haze-Density Indicators



1 Stack-haze-density indicator has a photoelectric tube and a 3-element amplifying tube in photoelectric unit at stack



2 Simplified form of Fig. 1 has only one relay, a red lamp, alarm bell to warn boiler operator of objectionable smoke



New Edge Moor Power Plant, now being erected for the Delaware Power & Light Co., Wilmington, Delaware. All piping fabrication for this project is being supplied by the Benjamin F. Shaw Company. Specifications: Piping to operate at temperature of 950° F. Main steam pressure at superheater outlet—1300 psi. Two boiler units, 600,000 lb. per hr.—to operate at 1300 psi., 950° F. Two 60,000 KW Turbo Generators—at 1250 psi., 950° F. United Engineer and Constructors of Philadelphia, Penna., Engineers.

whatever your piping requirements...

SHAW fills them quickly... dependably Shaw can handle any piping job... anywhere in the World. Shaw fabrication is a finished product, too...checked, cleaned, tested, accurate . . . ready to perform. You find it pays to consult Shaw first—for all your piping needs.

Benjamin F. Shaw Company is qualified to pre-fabricate and erect piping throughout the World.

President

BENJAMIN F. SHAW COMPANY

2nd & Lombard Streets **Wilmington, Delaware**

KNOWN SINCE 1893 for HIGH-QUALITY PRE-FABRICATION AND PIPING INSTALLATION

shows the wiring diagram for an Ess Instrument haze indicator that uses a phototube P and a 3-element amplifying tube E in the photoelectric unit. Indicator contains two relays C and C_1, a haze gage M, a red lamp R, and a green one G. Power comes from a 115-v ac circuit, which we will assume has the instantaneous polarity shown. Then current flows from the – line through lamp L on the side of the breeching, back through adjustable resistance R_1 to the + line. Resistor R_1 adjusts current through lamp L to give correct light density for operating conditions. Lamp L through a lens throws a light beam across the stack-gas stream on the cathode of phototube P.

Current also flows from the – line through resistance R_2, cathode heater of amplifying tube E, resistors R_3 and R_4, to the + line. This is the cathode-heating circuit, and adjustable resistor R_3 provides a means of tuning the tube to the desired sensitivity. Phototube circuit runs from – line through part of adjustable resistor R_5, tube P, to the + line. This circuit puts a minus potential on tube E grid. Grid circuit is from between resistor R_3 and phototube to the cathode, back to the + line.

Electron-Tube Action. Value of tube E grid potential depends on adjustment of R_3 and amount of light getting across the gas stream to phototube P. When dense smoke cuts off all light, tube P does not conduct and tube E grid potential is maximum, causing minimum current to flow through this tube. When gas is clear, as with too much excess air, maximum light reaches tube P; it conducts maximum current and puts minimum minus potential on tube E grid. As a result, this tube conducts maximum current.

Current also flows from tube E cathode to its anode through meters M_1 and M, relay coils C and C_1, and to the + line. Equipment is usually adjusted so, with haze of a density to give best combustion efficiency, current flow through tube E is just enough to hold meters M and M_1 pointers at midposition. This current is not enough to close relay C, but relay C_1 can hold its armature on its bottom contact. Under these conditions relay contacts open red and green lamp circuits.

Stack-Gas Density Increases. Assume something happens to the fuel-air ratio in the furnace to increase stack-gas density. Thus, less light reaches phototube P, which as previously explained increases minus potential on tube E grid. This reduces current flow through tube E, meters M_1 and M, and the relay coils to where relay C_1 releases its armature to close its top contact. A circuit for the red lamp is now completed from the – line through the red-lamp, relay C_1, top contact to + line. Red lamp lights to call attention to the smoke conditions and the meters indicate smoke-density increase.

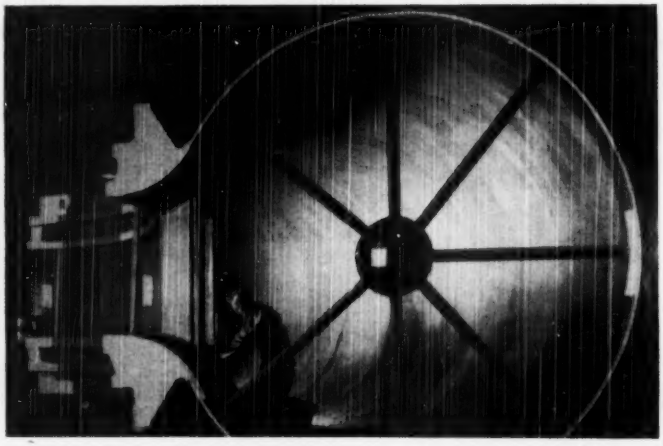
Stack-Gas Density Decreases. If gas density, due to too much excess air, decreases below a haze that indicates best combustion, more light reaches phototube P to decrease the minus potential on tube E grid. Current flow then increases through meters M_1 and M and the relay coils to where relay C closes its contact. A circuit is now completed for green lamp G from – line, the lamp, contact of relay C, bottom contact of relay C_1, and to the + line. Green light indicates stack gases are off-color on the light side, and the meters show the amount. If desired, a smoke-density recorder may be connected into the circuit. One lead of one magnet connects to A, and one of the other to B. Their common connection goes to the – line.

Simplified Smoke Indicator. Where the combustion job does not warrant the refinements provided by equipment in Fig. 1, smoke indicator (Ess Instrument Co) in Fig. 2 may be used. Circuits are somewhat similar to those in Fig. 1, but only a red light and, if desired, an alarm can be included. Cathode-heating circuit is from – terminal, cathode, resistor R_3 in parallel with R_2 and R_4, and back to + terminal.

Assume normal light reaches the phototube cathode, then its circuit is from – terminal, part of resistor R_5, phototube, resistor R_4 to + terminal. Because the phototube is conducting a normal current, potential on the grid of amplifying tube E is low and this tube conducts. Its circuit is from – terminal, cathode heater, cathode, anode, haze meters M, relay coil A to + terminal. Current in relay coil A holds contact B open so red lamp and alarm are not energized, showing stack-gas density is within legal limits. Capacitor C, connected across the haze meter and relay coil A, discharges through them on the reverse half of the ac cycle and prevents the relay from tending to chatter. This also applies to the capacitor, Fig. 1.

If smoke becomes dense, light is cut off from the phototube and it stops conducting. This increases the – bias on the grid of tube E to reduce current through it to where relay A releases its contact and closes the red light and alarm circuits through B. Minus potential is applied to the grid from the – terminal through part of R_5, the grid, cathode, R_3 in parallel with R_2 and R_4 and to + terminal. Current cannot flow from grid to cathode, but if the – potential between the two is high enough, current cannot flow through the tube.

As smoke density changes, – potential on the grid changes. Current flow through the amplifying tube E varies accordingly as will be indicated on the haze or smoke gage. So the boiler operator always has before him an indication of stack-gas density changes.



ALL-WELDED SPIRAL CASING SECTION, of plate steel, is for the first of three 62,000-hp 190-ft-head 128.6-rpm hydraulic turbines for U.S. Corps of Engineers, Bull Shoals Development, Arkansas. With its integral stay ring and temporary bracing, it weighs over 36,000 lb. It is being fabricated in Allis-Chalmers shops

NOW! AT NO INCREASE IN COST TO YOU

Makes a good steam trap better

Nearly 650,000 Yarway Impulse Steam Traps have already been installed—proof that they are doing a good job.

Now a *stainless steel* body makes this famous little trap even *better—at no increase in cost.*

Better in *wear*, better in *service*. Users will find Yarways require less maintenance than ever. All parts are wear-resistant, practically wear-proof. There is only one moving part, a small, stainless steel, heat-treated valve. Important, too—Yarway Impulse Traps are *suitable for all pressures up to specified maximum without change of valve or seat.*

Other popular advantages are *small size, light weight, easy installation* and *low cost.* Often it costs *less* to buy a new Yarway trap than to repair an old, ordinary trap.

In performance—ask any user. They all say Yarways are the traps that *get equipment hotter sooner and keep it hot!*

For better steam trap performance, try *new* stainless steel Yarways.

YARWAY IMPULSE STEAM TRAPS ARE SOLD BY OVER 200 DISTRIBUTORS. THERE IS ONE NEAR YOU.

Write for name and address.

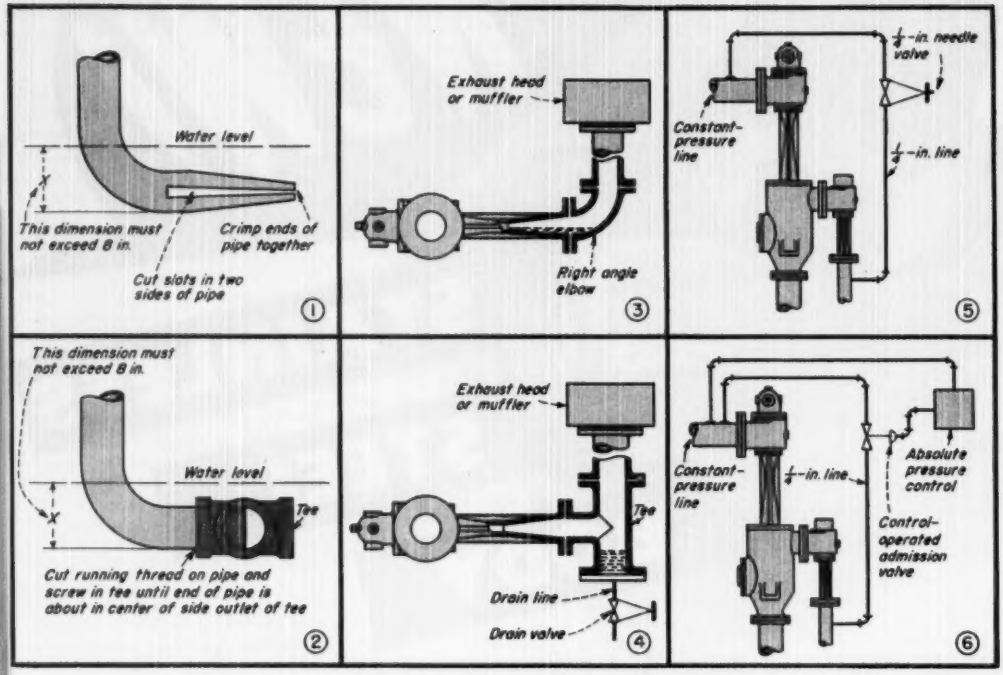
YARNALL-WARING COMPANY
100 Mermaid Avenue, Philadelphia 18, Pa.

YARWAY **IMPULSE STEAM TRAP**

POWER ENGINEERS' NOTEBOOK

PLANT-TESTED IDEAS TO SOLVE PROBLEMS OF DESIGN, OPERATION AND MAINTENANCE

POINTS TO WATCH WHEN INSTALLING STEAM-JET AIR EJECTORS



IF NOT PROPERLY ARRANGED, air-ejector exhaust discharging under water in hotwells or tanks can be very noisy, and produce an annoying rumbling and splattering. To minimize this, do not submerge the discharge-line outlet more than 8 in. below the water surface. Fig. 1 and 2, above, give details on two ways to design the outlet itself. In Fig. 1, cut two slots on the horizontal diameter of the pipe about three times the pipe diameter in length, and about one third its diameter in width. Crimp the ends together so that the exhaust steam flows out sideways, and the job's done.

In Fig. 2, thread the end of the discharge pipe so it takes a tee in the position shown. Surface of the pipe's outlet end should be about in line with center line of the side outlet. Place the axis of the tee so it lies in the horizontal position.

Never install the exhaust steam line from a horizontally positioned ejector, as shown in Fig. 3. Exhaust steam from the ejector condenses in the discharge line, pocketing in the elbow and outlet portion of the diffuser. Blocking the discharge like this causes unsatisfactory operation. Instead of an elbow use a tee fitting hooked up as shown in Fig. 4. If possible have a 3- or 4-ft run of pipe between ejector discharge flange and the tee. If not, use a tee one pipe size larger than the discharge flange and exhaust-steam piping. Drain valve should be kept open just enough to drain the exhaust line completely while the ejector is running.

Fig. 5 shows an arrangement to keep a constant absolute pressure on a system manually. Fig. 6 shows how to set it up for automatic control. Note that exhaust steam from the ejector is used as the admitted fluid. Do not use dry air because it may overload ejector, making it run unstable.

Courtesy Elliott Co, Jeannette, Pa.

(*Continued on page* 128)

The Editors Invite Contributions From POWER Readers

Here's your chance to cash in on one of those professional tricks you have used in your plant. POWER pays $20 for each item published here on problems in design, operation and maintenance. Your contribution need be in rough form only—just set down all facts with sketches in pencil. We will do any editing that is needed.

SUNTAC ENDS LUBRICATION HEADACHE

Keeps Plant in Full Operation and Reduces Oil Consumption 50%

Cold-rolling threads on cold-headed bolts is a tough operation, and a mighty big financial headache, if the thread-roller does not receive proper lubrication.

Such a condition developed in the plant of a well-known manufacturer of screw machine products. Oil ran out of bearings and would not adhere to the guides for the reciprocating die holder. On several occasions the main bearings overheated and seized up. In each instance four days' downtime resulted, costing a large amount for labor and 30 percent in bolt production. Furthermore, the oil loss became so excessive that maintenance crews actually had to put in extra work to keep floors clean and safe.

In his search for a solution to the problem, this manufacturer called in a Sun representative, who induced him to try Suntac Oil. In the 18 months which have elapsed, there have been no production losses attributable to inadequate lubrication, downtime has been eliminated, and cleanups have been reduced to a routine minimum. The consumption of oil has been cut in half. Savings on oil and maintenance have amounted to more than $3,000.

Suntac Oils are recommended for general lubrication in all machinery where retention of oil in bearings is a problem. These "Job Proved" products cling to the parts to be lubricated. For further information, call or write your nearest Sun Office.

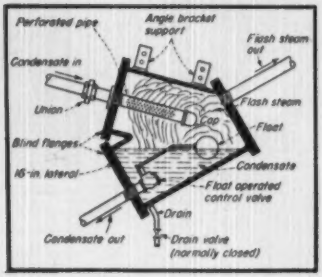
SUN OIL COMPANY · *Philadelphia 3, Pa.*
In Canada: Sun Oil Company, Ltd.
Toronto and Montreal

SUN PETROLEUM PRODUCTS
"JOB PROVED" IN EVERY INDUSTRY

SUNOCO

 (*Continued from page 126*)

INEXPENSIVE FLASH TANKS HELP TO SAVE FUEL



WE HAVE BUILT several simple flash tanks to recover steam from condensate that would otherwise be wasted. We use this steam for heating water and other jobs needing moderate amounts of steam. We figure we save from 5 to 10 tons of coal per year when using three tanks. This compares with negligible initial and maintenance costs and adds up to a neat profit.

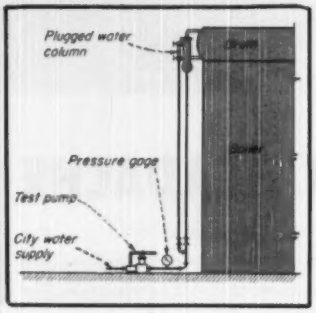
Sketch shows a scrap 16-in. lateral, fitted with cover plates on all ends. Make sure schedule number is suitable for top pressure in the system. Blind flanges served as cover plates. These were drilled and tapped for condensate-inlet pipe, steam-outlet pipe and condensate outlet. To speed up flashing, a series of holes were drilled through a capped pipe attached to the condensate inlet. The holes break the condensate into a fine spray, increasing the surface from which to release steam.

The ball float positions the outlet valve to control condensate level. Arrange the lateral so condensate collects at bottom as shown. For best results insulate the tank, but leave one flange uncovered for easy access when needing maintenance.

These tanks have proved reliable over a period of several years of service. They were well worth the time used in their construction. Tees or other pieces of old pipe could be used just as well to form the tank body. The only major precaution necessary in construction is the adjustment of the float valve. Make sure it doesn't allow condensate in the tank to rise enough to seal off the condensate inlet.

TYLER G HICKS *Summit, N. Y.*

CLEANING PLUGGED WATER COLUMN AVOIDS BOILER SHUTDOWN

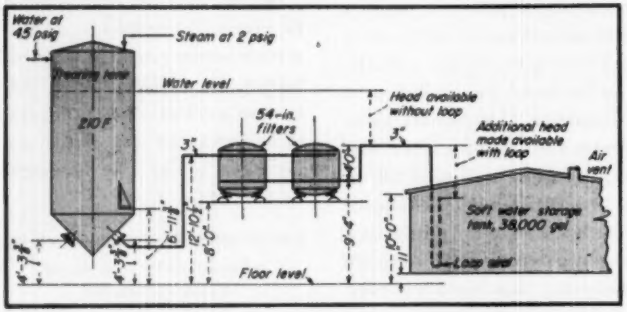


AT THE BEGINNING of each shift in our plant the operating engineer follows the routine of blowing down water columns and glasses. On one occasion the water column's blowdown line on one of the boilers plugged up. The valve was opened and closed several times and tapped lightly in both positions. This did not clear out the obstructing material. Not wanting to take the boiler out of service we decided to try putting reverse pressure on the line to dislodge the obstruction.

We had a hand-operated test pump and connected it to the blowdown line, as shown in the sketch. Boiler pressure was 150 psig and the fittings were rated for 250 psig. Pressure gage was inserted in the line to prevent pumping the test pressure above the equipment rating. When pump pressure reached 190 psig the obstruction cleared as shown by the sudden drop in gage reading to boiler level. Upon disconnecting the pump the obstructing material flushed out. This relatively simple operation avoided taking the boiler out of service with resulting losses and extra labor.

R E FONTAINE *Kenmore, N. Y.*

LOOP SEAL BRINGS SOFTENER CAPACITY UP TO RATING



IN OUR PLANT we have a hot-process softener supplying makeup water to our boilers. It's rated to deliver 5000 gal per hr, or 83.3 gpm, of treated water. This consists of about 86% raw water and 14% condensate.

We couldn't get the full flow when needed. The sketch shows there is gravity flow from the softener through the filters into the treated-water storage tank. Obviously, we didn't have enough hydraulic head. We had thought of putting a booster pump ahead of the filters, but this was unattractive because it entailed investment, operation and maintenance costs.

A simpler solution was a loop seal, which by reason of its simplicity and negligible cost was worth trying first. We were gratified to find after installing the loop, without making any other changes, that the flow rate increased from 52 to 83.3 gpm. The loop gives an additional head shown on the sketch by keeping the line full of water back through the filters.

JOHN R BROWN *Havana, Cuba*

Let's Talk About Your Boiler Plant

First, we should recognize that complete and efficient water conditioning starts with the raw water and continues through the plant, taking in many problems. "Trouble-spots" may occur at many points throughout the system—from the raw water intake to the boiler blowdown discharge.

Secondly, *correct* water conditioning is a matter of careful and scientific control. For proper results you should be sure to choose a water conditioning service offering the very best in up to date engineering practice.

W. H. & L. D. BETZ is an organization of engineers and chemists specializing in the solution of all industrial water problems. Years of experience have made Betz water conditioning service scientifically correct . . . complete . . . economical.

Our nationwide staff of engineers will welcome the opportunity of discussing with you this important subject of water conditioning . . .
W. H. & L. D. BETZ, Gillingham and Worth Streets, Philadelphia 24, Pa.
In Canada: Betz Laboratories Limited, Montreal 1.

BETZ

BOILER WATER CONDITIONING • COOLING WATER CONDITIONING • INDUSTRIAL WASTE TREATMENT

PROBLEMS FROM THE PLANT

THIS MONTH'S QUESTION

Why Don't Feedwater and Steam Flowmeters Jibe?

ABOUT TWO YEARS AGO we installed five new flowmeters to check steam output and feedwater input to boilers. Since that time we just can't get the total steam output figures to jibe with the feedwater input. At high-consumption periods the steam meters total more than the feedwater flow. The opposite holds true for low-consumption periods. Breakeven point is about 700,000 lb per day; see sketch below.

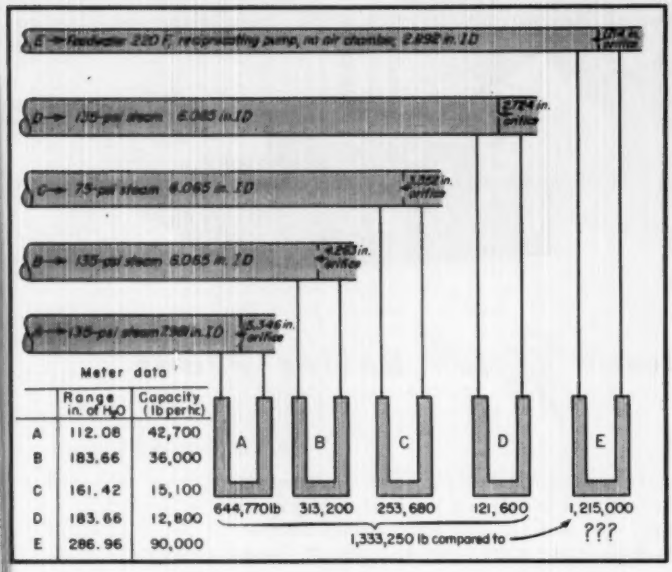
We've checked the meters up and down the scale with a manometer and their accuracy appears OK. We use undamped reciprocating feedwater pumps. Boiler concentrations indicate 3 to 5% blowdown.

We burn fuel oil in hrt boilers and figure 68 to 70% efficiency using the feedwater consumption figure, and 72 to 75% with the steam-flowmeter totals. On the face of that it looks like steam-flowmeter trouble. But what flaw in installation could cause a breakeven point at 700,000 lb per day? That's assuming there was an error in installation.

Here's another lead: Last summer we ran a calibrating test on the feedwater meter by checking the capacity of one of our boilers. This test showed the feedwater meter was 10% fast at 20% capacity, 14% slow at 40%, and 8% slow at 75%. This checked roughly with the feedwater integrator under actual conditions. There is no leakage through the bypass around the orifice. We even installed new valves to be sure of this point.

If we assume the steam flowmeters are correct we get an efficiency of about 75%. This seems too high for hrt boilers at an average of 11-12% CO_2.

Will any POWER readers come to our rescue?—*CH*



Exercise your engineering wits by submitting answers to this question fresh from the plant. Suitable material will be paid for; answers accompanied by sketches or photographs command additional pay.

Readers Answer the February Question

How Can We Separate Water From Lube Oil?

(This question from February issue is followed by best answers from readers.)

Here's one about lube oil and ammonia compressors. We have two mechanical lubricators—one for each of two 8x8 ammonia compressors—for oiling cylinder walls. After a long search, we tagged these two lube systems as responsible for getting water into the lube oil.

We always fill lubricators with pure oil. But on draining we often notice large quantities of water globules suspended in the oil. The same condition reappears a day or two after refilling.

My guess is that the water condenses somewhere within the working parts of the equipment during cold weather. Then again it may be that, because of traces of ammonia gas in the oil, it absorbs minute particles of water from the air. There is no other explanation since we carefully check all oil in front of a bright light before filling.

Is there a simple, inexpensive way to filter out this finely divided moisture that would fit well into our present lube setup? Yes, we have tried passing the oil through cotton cloth and through rayon but with only partial success; portion of water persists in coming through with the oil.—WK

I Suggest Distillation

WHY NOT USE fractional distillation of some sort, to remove water from lube oil? As the boiling range of oil is greater than 572 F, water would naturally become steam before this temperature was reached. Steam can then be condensed and drained. An aspirator could be attached to condenser drain to cause a slight vacuum to help the distillation.

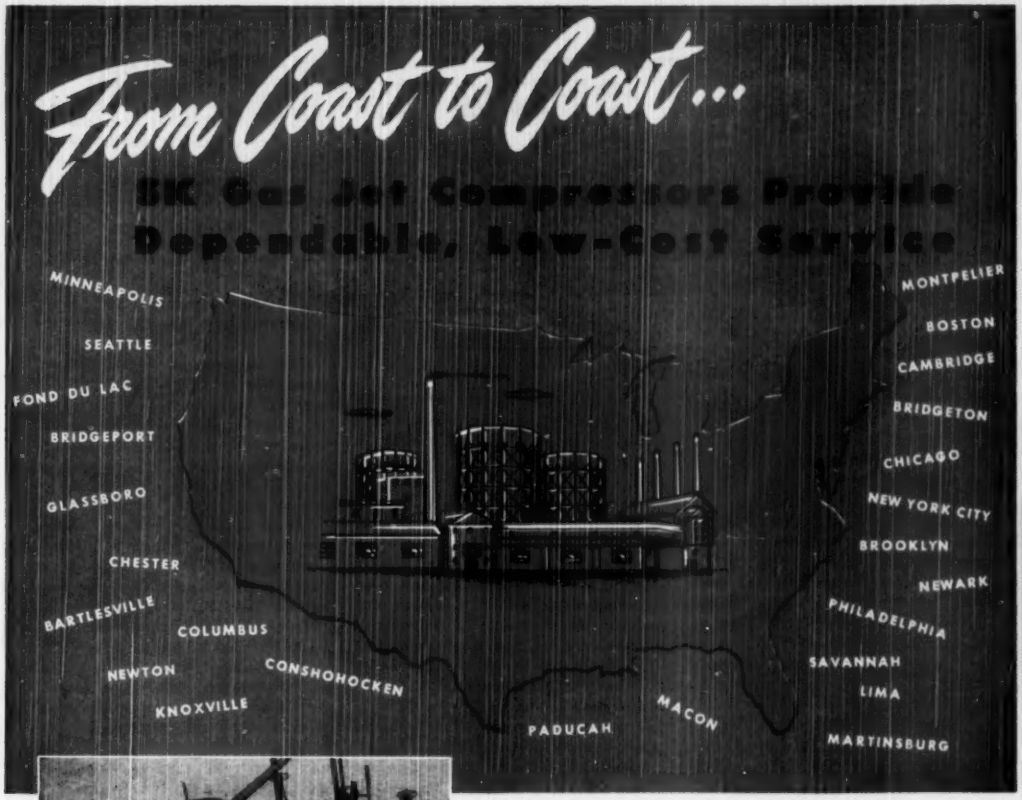
G S TROSKE *Bay City, Mich.*

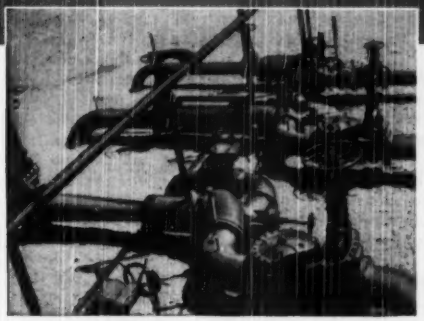
Keep Air Out With CO_2

WK's TROUBLE INTERESTED this ex-marine because he batted similar prob-

From Coast to Coast...

SK Gas Jet Compressors Provide Dependable, Low-Cost Service





A Typical SK Gas Jet Compressor Installation at the Plant of a Large Gas Company.

For dependable, continuous service . . . for an absolute minimum of maintenance . . . for lower initial cost, lower operating cost and maximum efficiency—gas companies from coast to coast are turning to SK Gas Jet Compressors.

Operating on the jet principle, these compressors mix Propane and Butane with air, natural gas with air or natural gas with manufactured gas in proper proportion to obtain desired heating value. The simplicity of operation, the lack of rotating parts and the ease in adjustment so characteristic of the jet make these compressors ideal for continuous operation or for peak load shaving.

SK Gas Jet Compressors are custom-built—can be designed for your particular problem. However, for prompt shipment, sizes up to 4" (a typical capacity range for this size being 34,000 cfh at 800 Btu's) are carried in stock. Write, call or teletype for complete information.

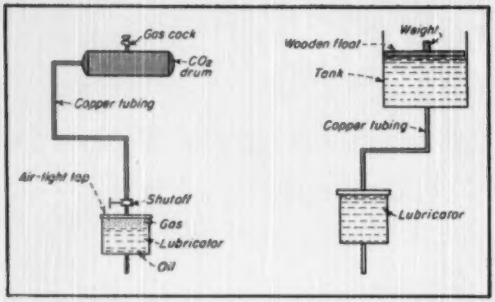
SCHUTTE and KOERTING Company

Manufacturing Engineers

1150 THOMPSON STREET • PHILADELPHIA 22, PA.

JET APPARATUS • HEAT TRANSFER EQUIPMENT • STRAINERS • CONDENSERS AND VACUUM PUMPS • OIL BURNING EQUIPMENT • ROTAMETERS AND FLOW INDICATORS • RADIAFIN TUBES • VALVES • SPRAY NOZZLES AND ATOMIZERS • GEAR PUMPS • DESUPERHEATERS

Phone: STevenson 4-0900
TWX NO. PH 782



lems around in the past. Here are four methods that worked well.

1. Keep air out of mechanical lubricators. Moisture in air condenses in lubricator and runs down into the oil. Accompanying sketches show two easy ways to keep air out. Both call for replacing air with a medium that won't mix with oil.

Left sketch shows how we connected a small drum to the lubricator after making the top air tight. Then we filled drum with CO_2 gas. Drum pressure was negligible—about ½ oz above atmospheric—but enough to prevent air leaking into the lubricator. We watched this setup closely for three months and never had a bit of trouble. After that we'd look at it only when lubricator required filling. Water in oil disappeared. The drum we used was from an old, small, hand fire extinguisher.

In another plant, when the same trouble popped up, we couldn't get any gas so we used a float, right sketch. A small cylindrical tank, above the lubricator, gave constant feed. Float, tightly fitted in tank, kept air off the oil. We put an old lead fishhook sinker in the middle of the float to make sure its movement was positive. Result, no water in oil.

2. In a hospital plant, the engineer solved his water-in-oil problem with a funnel of medical dusting powder (a hydrous aluminum silicate called fuller's earth) through which he filtered the oil. Close examination of this oil showed it never contained a drop of water after proper filtering.

3. In another case we salvaged a small laboratory centrifugal and tried removing water with it. At room temperature we were able to get most of the water out but a bit always remained. Then we heated the oil over a Bunsen burner before centrifuging. At an oil temperature of 210 to 230 F, all moisture could be removed. Exact temperature necessary appeared to depend on the particular oil, but in the range given it was always possible to remove all water by centrifuging.

4. *WK* should check his oil-storage area. Sweating pipes above oil cans may drip water. Keep oil cans closed at all times. I've seen some marine chiefs put a lock on the can.

If *WK* uses any or all of these methods he'll have a good chance of getting rid of the water. Cotton and rayon are OK for solids but aren't very effective for water.

TYLER G HICKS *Summit, N. Y.*

Filter Press Works Fine

WE HAVE FOUND a mechanical filter press the answer to our problem where 30 gpm are forced through 20 stages of filter paper. An end product is produced that is on a par with refinery oils. A 3-hp 460-v motor driving a centrifugal pump forces the oil through 30 square feet of paper filter pads. These pads may be dried repeatedly in the oven and are only replaced as the pores become clogged with solids.

We then use a high-potential breakdown test for oils requiring high dielectric strength and complete freedom from water. Such oils are used in transformers as a cooling medium. Other oils in the hydraulically powered elevators and presses, or closed-circuit oiling systems on machinery, do not require the high-voltage test.

PAUL C ZIEMKE *Oak Ridge, Tenn.*

Typical System Explained

AMMONIA REMAINING in oil does absorb water from atmosphere. Then, too, ammonia may have some water combined with it when withdrawn from the system. The ammonia evaporates, leaving oil and water behind.

Unless the system is operated at suction pressures below atmospheric, the only likely source of water is from piston rods of a horizontal machine. If frost is dripping on the rod, water may be carried into the cylinder.

A little water in the oil does no great harm when fed to the ammonia cylinders. It should not be used for bearings, however. Most bearing-lubrication systems pump oil through a filter and back to the bearings; oil is not withdrawn from the system.

WK does not say how oil is removed from the system, nor how it is cleaned after being withdrawn. Here's a thumbnail sketch of our system that uses and withdraws three gal each day; see below.

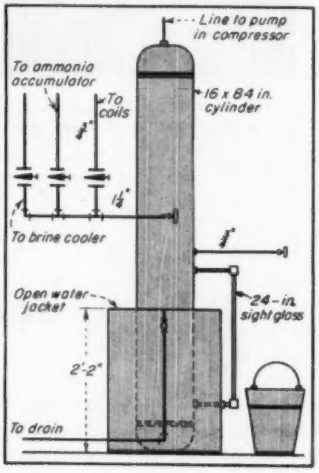
Cylinder pressure is held at compressor suction pressure at all times. Whenever valves, in lines leading to receiver, brine chiller, or direct-expansion coils, are opened, oil and liquid ammonia are pulled over to this cylinder. Depending upon the differential pressure, this may take 3 to 20 minutes.

When oil is cold it flows slowly at low differentials. If there is any equipment at a level much below the cylinder it is necessary to close compressor suction valve so enough differential is obtained to cause liquid flow. After liquid has been pulled into receiver and valves to left closed, suction valve of compressor may again be opened.

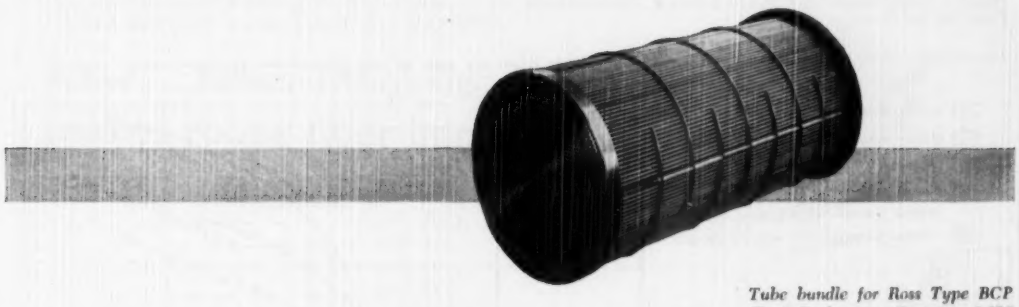
Cylinder contains about 36 in. of a mixture of oil and ammonia. It will be frosted to this same height. Jacket is now filled with water at 90 to 130 F. Ammonia boils off and returns to the system leaving oil behind.

After three or four hours frost on cylinder disappears and oil may be drained out. Amount obtained should equal amount fed to the system. If daily records are kept and amounts do not balance, it is a sure indication that some oil still remains in the system.

(*Continued on page* 170)



What technical service can Anaconda give you on Condensers and Heat Exchangers?



Tube bundle for Ross Type BCP Heat Exchanger. Contains 2,082 ANACONDA *Arsenical Admiralty Metal Tubes. Tube Sheets are* ANACONDA *Muntz Metal. Baffle plates, tie rods and spacers are* ANACONDA *Brass.*

Every large user and manufacturer of condensers and heat exchangers builds up wide experience with tube and tube sheet materials. The American Brass Company serves many such users and manufacturers, shares with each their toughest problems, makes this wider experience available to all.

We maintain special laboratory facilities for this work—keep detailed records of problems, conditions, findings—use this data plus the results of continuous laboratory and field tests to solve new problems.

These facilities can help produce the answers to your questions—suggest materials that will give your condensers and heat exchangers more dependability, longer life, more value under specific conditions.

We hope you will work with us and let us work with you. Write for Publication B-2, *Anaconda Tubes and Plates for Condensers and Heat Exchangers.* Please address The American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

B0115

For efficient heat transfer ANACONDA HEAT EXCHANGER TUBES

TECHNICAL BRIEFS

ENGINEERING DEVELOPMENT HERE AND ABROAD DIGESTED FOR BUSY POWER MEN

REVIEWED IN THIS ISSUE

GAS TURBINES: Test Experiences With Annapolis 3500-Hp Experimental Plant • The Prospects of Gas Turbines in Naval Applications • Marine Gas-Turbine Research in Britain

STEAM STUDIES: Furnace-Exit Temperatures • Trends and Opportunities in the Small Industrial Steam Plant • Use of a Model to Study Steam Separation in Boilers • Thermodynamic Properties of Mercury

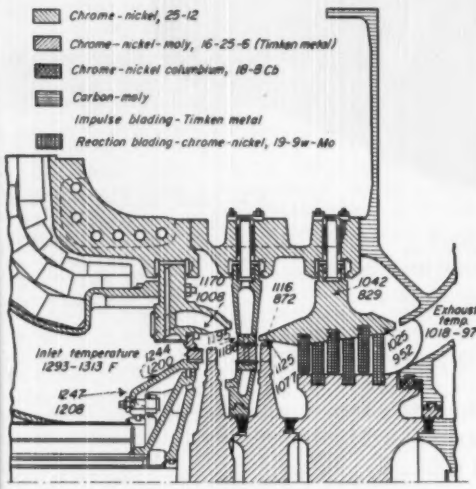
ELECTRICITY: Power Supply for Multi-Transformer Welding Presses • Modern-Type High-Power Circuit Breakers

SAFETY: Industrial Safety Is Good Business

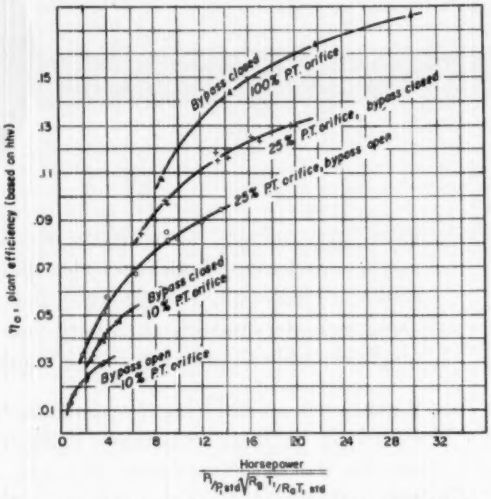
HEAT PUMP: Earth-Heat Pump Research

CONTROLS: Some Basic Studies in Proportional Control

Directions for ordering papers are given on page 136



1 Turbine metal temperatures for 1300-F inlet gas temperature without cooling air (upper numbers), and with (lower)



2 Interchangeable orifices in inlet served as throttles; bypass reduced compressor resistance; both plot efficiency

Gas Turbines

TEST EXPERIENCES WITH THE ANNAPOLIS 3500-HP EXPERIMENTAL GAS-TURBINE PLANT, *by A C Skortz and F R Gessner Jr, U.S. Naval Engineering Experiment Station, Annapolis, Md.* Test plant has a rated capacity of 3060 hp based on 80-F ambient temperature at sea level, with a compressor speed of 5180 rpm and turbine inlet temperature of 1500 F. From initial operation on Dec 7, 1944 to Jan 1, 1950, the unit ran a total of about 3200 hr, consuming 500,000 gal of diesel fuel and compressing about 7 billion cu ft of air.

Maximum plant output was 2990 hp, corrected to standard inlet conditions, with 1500-F inlet temperature. Fig. 2 shows over-all plant performance.

Internal adiabatic efficiency of compressor at rated speed and compression ratio of 4 is 84%. This corresponds to a flow rate of 56.4 lb dry air per sec. Maximum compressor efficiency of 85.4% occurs at 4400 rpm with an air flow of 44 lb per sec and a compression ratio of 3.6. Once when blading had been hand polished but the casing incompletely cleaned, an efficiency of 87.75% was attained. This was attributed to the dirt accumulation on the casing surface reducing blade-tip clearances.

Fig. 1 shows the turbine metal temperatures with and without blade cooling for 1300-F inlet-gas temperature. Upper figures are without cooling air, and lower figures are with cooling-air flow. On one run with compressor speed constant, plant output rose 4% and turbine-inlet temperature dropped 40 F when cooling air was turned off.

After 1384-hr operation three blades in the first reaction stage of one turbine were thrown, damaging all three reaction stages. Blades failed from a fatigue fracture at a sharp change in section in the blade root. Replacement blading was made with an integral-type root. No difficulty has been experienced since.

On July 29, 1947, about 12 min after the burner had been ignited its wall failed at a point directly underneath the baffles of the whirl-chamber entry. Molten metal and hot gas discharged through the opening. This condition was caused because a gate valve just before the combustion chamber was only cracked open. Resulting high-pressure drop caused an air jet to enter the combustion chamber in such a direction as to cause flow reversal within one section of the whirl chamber. Combustion gas melted one of the baffles, which

For 3500 years,
ramie fiber resisted rot
in an Egyptian tomb...

Now...Johns-Manville makes ramie fiber into the rot-resistant packing...

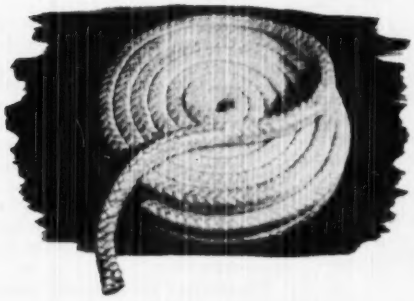
That's why NAVALON stands up where other packings fail!

IN PLANT AFTER PLANT, this new Johns-Manville packing made from ramie fiber is establishing new records in reciprocating service against fresh or salt water, brine, cold oil and many other liquids.

Navalon's rot-resistant properties are only one reason for these outstanding performance records. Navalon also has the high tensile strength inherent in ramie, nature's strongest fiber. An exclusive Johns-Manville process of manufacture gives it unusual lubricating properties, too—another reason for its ability to outlast other cold liquid service packings. And, in addition, Navalon is free from any tendency to score.

In the toughest service, users are finding that this unique combination of properties not only means less repacking—it means less wear on rods and plungers as well—money-saving performance all around.

Why not investigate Navalon as a means of increasing packing life and reducing costs in your plant? Get in touch with your packing distributor, or send for folder PK-32A that tells the full story. Just fill in the coupon below.



Johns-Manville
PACKINGS & GASKETS

Johns-Manville
Box 290
New York 16, N. Y.

Please send me your folder on Navalon Packing (PK-32A).

Name_____

Company_____

Address_____

City_____ State_____

POW-5

in turn caused the combustor wall below to burn through.

When taking down the unit for inspection after the 1500-F run the first- and second-stage turbine was eroded from metal-particle impingement. Considerable scale and debris were found in the stagnant regions of the turbine. This came from spalling and flaking of the 18 Cr-8 Ni liners of the combustion chamber. Replacing them with 25 Cr-20 Ni stainless steel eliminated the condition. *ASME paper No. 50-S-12.*

THE PROSPECTS OF GAS TURBINES IN NAVAL APPLICATIONS, *by Comdr R T Simpson, USN, and Cmdr W T Sawyer, USN.* Fitting the gas turbine into an active Navy is difficult. First, the art of gas-turbine design and development moves so fast that to fix on one design in one year makes a finished machine almost obsolete by design standards when it is ready for service.

Second difficulty is the special problem the naval plant presents. This problem is created by need for: (1) excellent cruising—fuel economy at light load as well as high (2) maneuverability—ability to accommodate rapid changes in power from low load to high (3) air economy so intake and exhaust ductwork can be kept small (4) resistance to severe shock or other battle danger (5) economy of strategic materials since the heavy building program would probably take place in wartime shortage periods.

When it comes to predictions of the gas turbine and its future, the authors feel that what this country needs is some down-to-earth performance records on the gas turbine. Then you could build from there.

The authors discuss certain operating characteristics of great importance to the Navy. Importance of satisfactory turbine cooling, for example, is emphasized and the probability that liquid cooling is the optimum method for naval craft. A specific arrangement of a gas turbine for ship propulsion is described. *ASME paper No. 50-5-8.*

MARINE GAS-TURBINE RESEARCH IN BRITAIN, *by T W F Brown, Parsons and Marine Engineering Turbine Research & Development Assn.* In Britain all research on gas turbines falls into the following categories: (1) government research establishments and government contracts to firms (2) research associations (3) research carried out by private firms. Universities also have research facilities but they are limited in scale.

The author lists the government departments dealing with gas-turbine work and briefly describes their interests. A table carrying all marine gas turbines under construction in Britain shows most of the important ones to be under Admiralty order.

Marine turbine-propulsion machinery is generally produced by engine works belonging to ship-building companies or closely associated with them. These firms have formed the author's association which for brevity's sake has been commonly referred to as Pametrada. This unit will carry out research development on steam- and gas-turbine machinery and transmission. It has already received contracts from the Admiralty and has built a long-life gas-turbine propulsion set of 3500 shp output at 85 rpm.

Apart from this phase of research Pametrada is engaged in testing fluid couplings, helical reduction gearing, and auxiliaries associated with gas-turbine work so the whole question of starting, maneuvering and running gas-turbine machinery at sea can be fully explored.

After this background the author goes on to present many of the findings of the British and to predict some of the development possibilities. *ASME paper No. 50-5-3.*

TO OBTAIN COMPLETE TEXT

Material for these abstracts comes from one of the following sources unless otherwise noted:

American Society of Mechanical Engineers, annual meeting, New York, N. Y. Nov 28-Dec 1, 1949, spring meeting, Washington, D. C., April 12-14, 1950. Papers are identified by initials ASME. Obtainable through ASME, 29 W 39th St, New York 18, N. Y.

Midwest Power Conference, annual meeting, Chicago, Ill., April 5-7, 1950. Papers are identified by initial MWP. Obtainable in proceedings ($3.00) from E R Whitehead, Secy, Illinois Institute of Technology, 3300 Federal St, Chicago 16, Ill.

American Institute of Electrical Engineers' welding conference, Detroit, Mich. April 5-7, 1950. Papers are identified by initials AIEE. Obtainable through AIEE, 29 W 39th St, New York 18, N. Y.

Steam Studies

FURNACE-EXIT TEMPERATURE, *by Jens T Holm, professor, marine engineering, Webb Institute.* In marine steam power plants *(Editor's note:* stationary plants, as well), the designer is rarely called upon to actually design the various units, boilers, turbines, etc. He is called upon, though, to check these designs. To do the checking he relies on various criteria of service. But they are not dimensionless and so extreme caution should apply.

Peak temperatures of tubes, refractories, gases are indexes of operating conditions and loading. Maximum temperature occurs in the furnace proper but it exists well within the flame and in very limited areas. So the real determining factor of operating conditions is the temperature of gas leaving the furnace. In fact, it is a far better criterion than equivalent evaporation because two boilers with the same furnace arrangements and operating temperatures may differ only in convection surface amounts. The one with the larger convection bank would, by the equivalent evaporation criterion, seem the more conservative design.

Actual amount of heat absorbed within the furnace proper depends on many factors, some of which are tube surfaces, flame temperature, tube cleanliness, good feedwater. As long as the tube is clean, high heat absorption seems no problem. But a relatively thin scale inside the waterwall and screen tubes produces an excessive metal temperature.

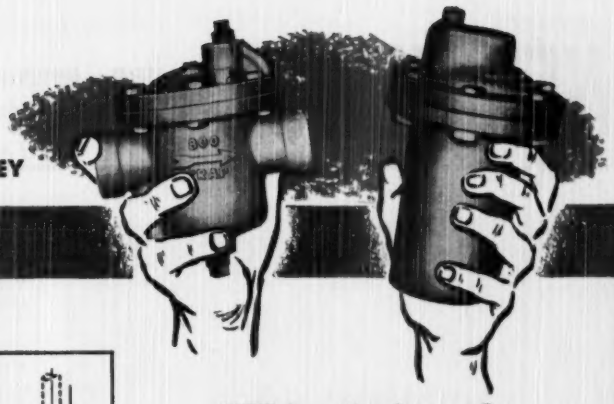
Calculation of furnace-absorption rates is a corollary of the prediction of furnace temperature. This paper presents the necessary data and formulas for making these calculations. Further, the existing formulas and data are correlated with some empirical constants to furnish a simple method for estimating furnace absorption rates and exit temperatures. *Journal of the American Society of Naval Engineers, Inc, Feb 1950.*

TRENDS AND OPPORTUNITIES IN THE SMALL INDUSTRIAL STEAM PLANT, *by S E Friedeberg, Franklin Engineering Co.* Many plants spend thousands of dollars annually to develop and maintain production systems. Yet, though steam is an important factor in the manufacturing process, they don't know how much it costs. Too often, improvement or expansion of an existing steam plant, and sometimes the building of a new boiler house, gets under way without any basic engineering data.

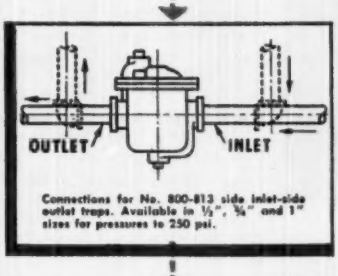
Preconceived ideas on recommendations for a plant of a certain size should not be used. Seldom are two plants alike. If they have similar loads, they differ in fuel, water, personnel or some other factor. Equipment cost, meters, etc for recording production rarely exceed one half of one percent of the fuel bill. In small steam plants, hand-

(*Continued on page* 162)

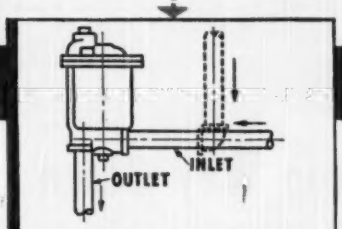
YOU SAVE
TIME AND MONEY



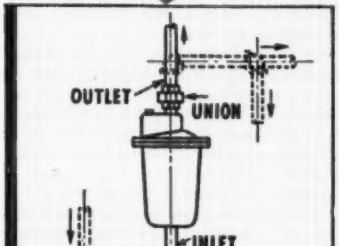
"This choice of
Steam Trap Body Styles
simplifies
installations"



Connections for No. 800-813 side inlet-side outlet traps. Available in ½", ¾" and 1" sizes for pressures to 250 psi.



Side inlet-bottom outlet trap, ½" or ¾". Greatly simplifies connections to many types of small steam-consuming units.



Bottom inlet-top outlet body style. ½" through 2" connections. Cast semi-steel bodies for pressures to 250 psi. Forged steel bodies for pressures to 1500 psi.

IN THE most widely used sizes, Armstrong Steam Traps are available in either side inlet-side outlet or bottom inlet-top outlet body styles. This gives the user an opportunity to make exceptionally neat installations with a minimum of fittings and a minimum of labor and permits correct location of the trap in relation to the unit being drained.

In both styles the entire interior mechanism may be taken out for inspection or repair simply by removing the cap. The body, full of boiling water, is left in the line. In the case of the side inlet trap the cap may be removed without even disturbing the pipe connections.

Ask your nearby Armstrong representative to show you the opportunities for simplifying trap installations.

ARMSTRONG MACHINE WORKS
812 Maple St., Three Rivers, Mich.

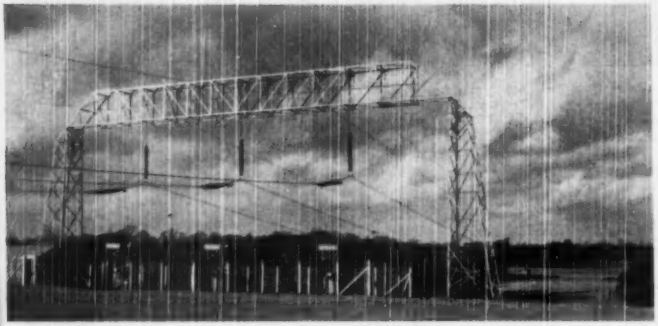
THE 72 PAGE ARMSTRONG STEAM TRAP BOOK gives data and prices on the complete line of Armstrong steam traps for every pressure, every application. This book is a valuable reference for the calculation of condensate loads and the selection of traps for all classes of equipment. Send for free copy today

SEE OUR CATALOG IN SWEET'S

ARMSTRONG STEAM TRAPS

POWER NEWS

BUSINESS ITEMS • APPOINTMENTS • FOREIGN FIELDS
WASHINGTON NOTES • NEW DEVELOPMENTS • CONVENTIONS



Britain to Tie in All Power on Super Grid

McGRAW-HILL WORLD NEWS—Super-grid transmission facilities will be built by the British Electricity Authority to permit bulk transmission of electricity when required, and a pooling of the nation's power-generating stations. An experimental test station, above, has been continuously energized since Nov 30, 1949 to gain experience on both operating problems and equipment for this high-voltage duty

COMING EVENTS

May 3-5—Technical Air-Pollution Conference, Dept of Interior, Washington, D. C.; Sid Gotlieb, chairman, Bureau of Mines, Washington, D. C.

May 9-10—Industrial Coal Conference, Purdue Univ, Lafayette, Ind. Prof R A Spaulding, School of Mechanical Engrg, Purdue Univ, Lafayette, Ind.

May 21-25—Smoke Prevention Assn of America, Mount Royal Hotel, Montreal, Can. A E McGruer, chairman.

May 23-26—National District Heating Assn, annual meeting Grove Park Inn, Asheville, N. C. John F Collins, Jr, secy-treas, 827 N Euclid Ave, Pittsburgh 6, Pa.

June 7-9—Wisconsin Power Conference and Exposition, Schroeder Hotel, Milwaukee, Wis. Walter W Roock, secy, 3430 W Forest Home Ave, Milwaukee 15, Wis.

Synthetic-Fuel Costs Drop Way Down

Secretary of Interior Oscar L Chapman revealed in his 1949 annual report to Congress that liquid fuels from oil shale and coal had made broad advances toward becoming competitive fuels.

Refined products from oil shale and coal cost 7.3 and 10.8c a gallon respectively. If a profit of 6% on unamortized capital investment is added on, plus income taxes, wholesale prices at the plant go to 9c a gallon for oil shale and 14.5 for coal.

As knowledge improves, costs will go down still further. Most of the emphasis today has been on operation—getting the kinks out of the methods coming from the laboratories. Once over this hurdle, attention will revert to design and construction improvements.

The industry when established—and it is sure to be, in the opinion of Secretary Chapman—will provide jobs for a growing population and much needed stability for the coal industry.

Right at the moment more than half of all fuel energy used in the U. S. comes from petroleum and natural gas. Security of our liquid-fuel position would be greatly enhanced if the supply were based in an increasing degree on oil shale and coal. They comprise roughly 95% of our total fuel reserves.

In the last three decades our use of the various fuel reserves has changed considerably. In 1920, per capita figures showed a coal use of 6 tons per person. Today, it is 4½ tons. Oil, on the other hand, has gone from 4 1/3 barrels to 14 1/3; natural gas from 7500 cu ft to about 35,000.

The Army's Corps of Engineers is making a comprehensive survey of 39 states and Alaska to determine (1) raw materials for commercial synthetic fuels (2) water (3) power (4) transportation (5) housing (6) labor (7) markets. Sample surveys completed in Colorado, Kentucky, Montana and Texas indicate no scarcity of sites. These areas alone could support plants producing up to 7 million barrels of gasoline and oil daily—about 20% above present consumption.

Capital investment, now required for a plant producing 10,000 barrels a day of crude shale oil or 8840 barrels daily of refined products, is $41,381,000 including facilities for mining, retorting and refining. This makes an average of $4138 for each daily barrel of crude capacity, or $4681 for each daily barrel of finished product. This plant would produce jet or diesel oil primarily, plus a small amount of fuel oil. Sulfur and nitrogen removal are no longer a problem. Motor gasoline may be readily produced by modifying the refining process.

Production costs for shale-oil products are not within or very near competitive range of those for petroleum. Construction of a 50,000-barrel-per-day pipeline could carry the oil to large consuming centers at a cost of less than 1c a gallon.

Estimated capital outlay for a coal hydrogenation plant producing 30,000 barrels a day is $246,800,000, or $8227 for each daily barrel of product capacity. High-octane gasoline would be the principal product. Byproducts would include liquefied petroleum gases and phenol. Product distribution could be readily changed to include aviation gasoline to improve profit possibilities. Aviation fuel (100/130 grade) now quoted in coal regions at 10-16c a gallon could be sold at the plant for 16.6c a gallon wholesale, compared to 14.5c a gallon for automotive gasoline from coal.

(*Additional News, page* 210)

Some Facts You Should Have on Slime and Algae Control...

Cooling tower algae growths are often blamed for plugged condensers and troubles in other heat exchange equipment... At left Nalco Microbiological Laboratories' investigations reveal the true culprits, see text below...

ALGAE, the trouble-makers in cooling towers, seldom cause plugging, corrosion or iron oxide deposits in other parts of cooling systems ... Nor can mold growths, slime-forming, sulfate-reducing and iron-depositing bacteria that do cause these internal difficulties be controlled with most algae-killing chemicals.

These established facts make it obvious that proper control of microbiological growths in any cooling system is first a job for experts. Proper identification, selection of treatment chemicals and dosages, and proper points of application will be handled efficiently and economically in your plant by Nalco Field Representatives, working closely with the Nalco Laboratories. Once proper microbiological control is established, consistent supervision to check effectiveness of treatment is all that is necessary to insure clean, slime- and algae-free equipment throughout your cooling system.

Your copy of Nalco Reprint No. 6, "A Practical Approach to the Problem of Cooling-Water Slime," will be sent promptly upon request ... If your slime and algae control problem requires corrective action, now, write or call for a Nalco Field Representative.

FORMULA FOR SUCCESSFUL SLIME AND ALGAE CONTROL

- Identify slime-forming organisms to be controlled.
  A NALCO SERVICE
- Determine the best types of treatment to be used.
  A NALCO SERVICE
- Determine, by detailed survey, the proper method of application.
  A NALCO SERVICE
- Provide consistent supervision to check application and effectiveness of treatment.
  A NALCO SERVICE

NATIONAL ALUMINATE CORPORATION
6222 West 66th Place • Chicago 38, Illinois
Canadian inquiries should be addressed to Alchem Limited, Burlington, Ontario, Canada

THE *Nalco* **SYSTEM** • **Serving Industry through Practical Applied Science**

JENKINS PRACTICAL PIPING LAYOUTS

52

How to plan

PACKAGE BOILER CONNECTIONS

Package Boiler units for power generation, heating and industrial process work are rapidly growing in demand due to their efficient and economical operation. They are generally available in sizes from 20 to 500 boiler horsepower and for pressures up to 900 p.s.i. Boilers may be of the fire tube or water tube type designed for any type of fuel. The unit illustrated here is of the fire tube type, designed for 100 p.s.i. and is gas fired. All piping connections are in accordance with the latest A.S.M.E. Boiler Code requirements.

Two means of boiler feed are provided, the normal feed from condensate return and the emergency feed by means of a manually operated steam injector. A dual low water cut-off and boiler feed control is provided with float and electrode type cut-offs and boiler feed control for maintaining constant water level incorporated in a single unit.

The failure of feedwater from the normal source would cause this dual unit to cut off the fuel supply and sound an audible alarm. If boiler operation is required immediately, cold water make-up can be introduced through the manually operated steam injector. When proper boiler water level is regained, the controls open the fuel feed which is always controlled according to boiler pressure.

Bronze Swing Check Valves, Jenkins Fig. 762, are recommended for the very important normal and emergency feed lines. Alternate Iron Body, Y and Angle Valves are listed for blowdown assembly installations where iron valves are preferred over bronze valves. Fig. 956, a Bronze Globe Valve, also used in this layout, is especially suitable for service where tightness is essential. Stainless steel plug and seat can be reground without removing valve from line—can be reground repeatedly before renewal is necessary.

Consultation with accredited piping engineers and contractors is recommended when planning any major piping installations.

A CHOICE OF OVER 500 VALVES

To save time, to simplify planning, to get all the advantages of Jenkins specialized valve engineering experience, select all the valves you need from Jenkins Catalog. It's your best assurance of lowest cost in the long run. Despite their extra value, you *pay no more* for Jenkins Valves.

Jenkins Bros., 100 Park Avenue, New York 17.
Jenkins Bros., Ltd., Montreal.

Reserve your copy of
NEW BOOK OF PIPING LAYOUTS — NOS. 26 to 50

A new book of Jenkins Practical Piping Layouts — Nos. 26 to 50 — is in preparation. Mail coupon to get your copy when ready.

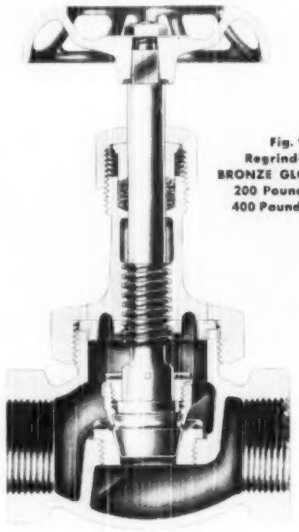


Fig. 956
Regrind-Renew
BRONZE GLOBE VALVE
200 Pounds Steam
400 Pounds O.W.G.

JENKINS BROS., 80 White St., New York 13, N. Y.
Reserve book of Piping Layouts—26 to 50—for:

Name _____

Company _____

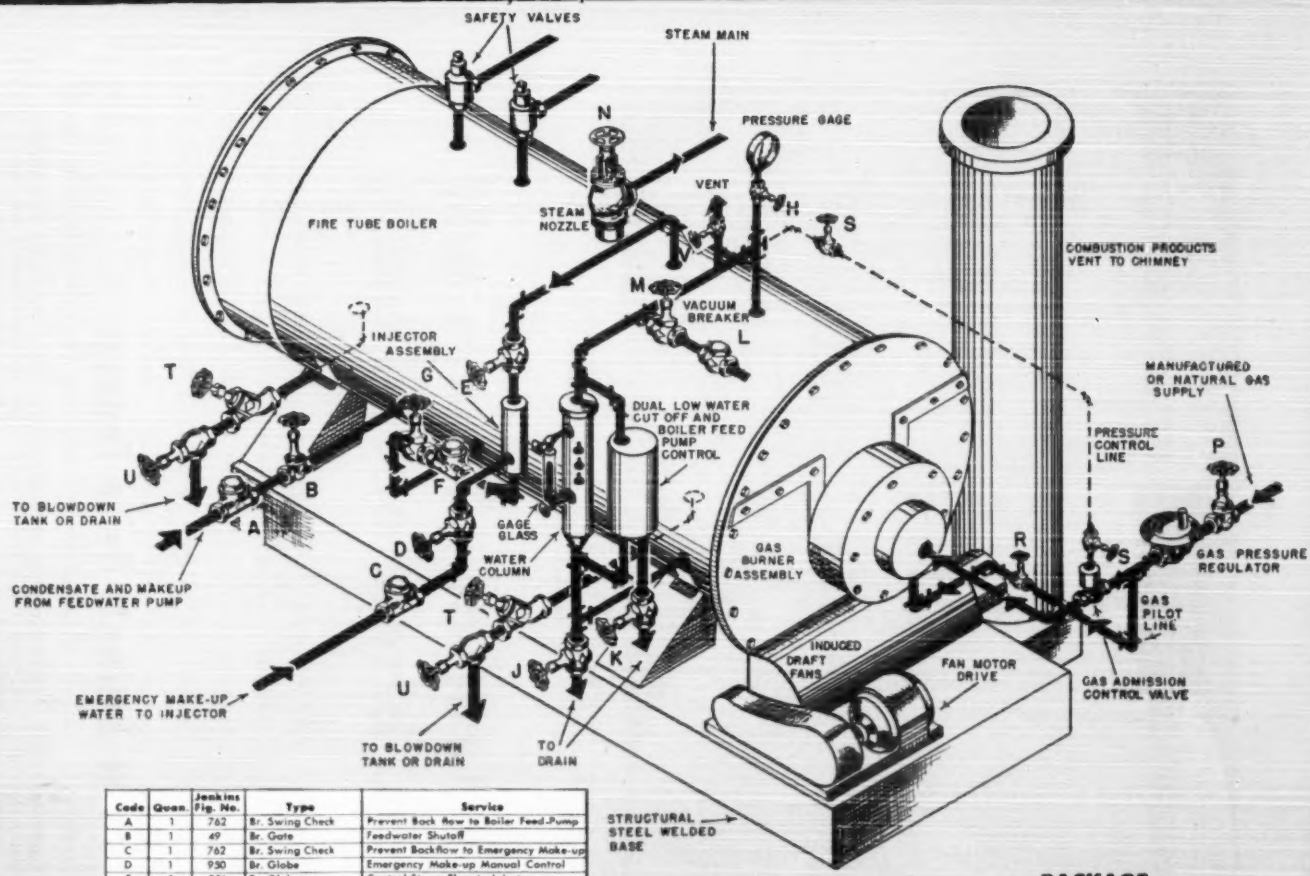
Address _____

Illustrating the proved 3-point formula for trouble-free, time-defying hookups

A **Use the right type valve for the service**

B **Place valves correctly in the line**

C **Choose Jenkins for lifetime economy**



Code	Quan.	Jenkins Fig. No.	Type	Service
A	1	762	Br. Swing Check	Prevent Back flow to Boiler Feed-Pump
B	1	49	Br. Gate	Feedwater Shutoff
C	1	762	Br. Swing Check	Prevent Backflow to Emergency Make-up
D	1	950	Br. Globe	Emergency Make-up Manual Control
E	1	956	Br. Globe	Control Steam Flow to Injector
F	1	762	Br. Swing Check	Injector Mixture to Boiler
G	1	950	Br. Globe	Emergency Make-up Admission to Boiler
H	1	741-G	Br. Needle	Pressure Gage Control
J	1	956	Br. Globe	Water Column Blowdown
K	1	956	Br. Globe	Blowdown Control
L	1	756	Br. Lift Check	Vacuum Breaker Air Admission
M	1	950	Br. Globe	Vacuum Breaker Shutoff
N	1	925	I.B.B.M. Angle	Steam Nozzle discharge
	1	293	I.B.B.M. Angle S & C	Where 2 or more boilers feed one system
P	1	370	Br. Gate	Gas Shutoff
R	1	741-G	Br. Needle	Gas Pilot Shutoff
S	2	741-G	Br. Needle	Pressure Control Line Shutoff
T	2	124	Br. Blowoff	Blowdown assembly
	2	297	I.B.B.M. Blowoff	Blowdown assembly
U	2	952	Br. Angle	Blowdown assembly
	2	615	I.B.B.M. Angle	Blowdown assembly
V	1	741-G	Br. Needle	Boiler Vent Valve

VALVE RECOMMENDATIONS
For details of valves to suit varying conditions see Jenkins Catalog

Diagram by Hussey Madeheim
Consulting Engineer

PACKAGE BOILER CONNECTIONS

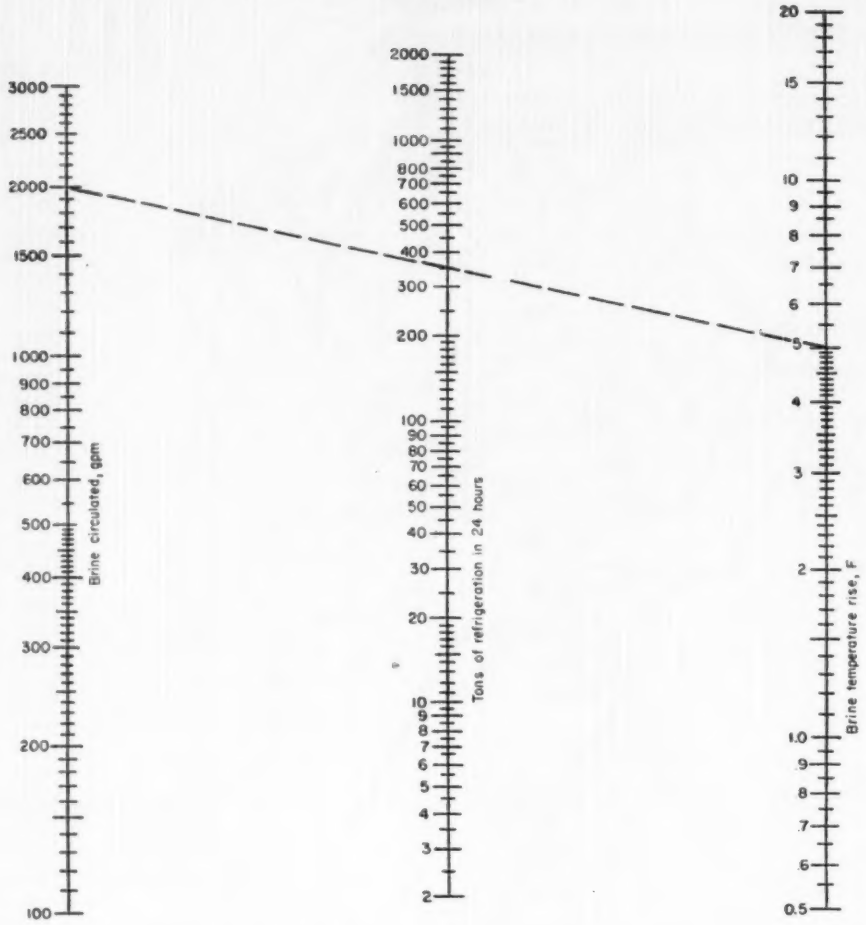
JENKINS VALVES

LOOK FOR THE DIAMOND MARK

SINCE 1864

JENKINS DIAMOND MARK

Number 215



How to Estimate Brine Tonnage

► HERE'S A TOOL for quickly estimating the amount of refrigeration tonnage in a given flow of brine. The nomogram is based on a brine having a specific gravity of 1.240 and a specific heat of 0.686 Btu per lb. A brine of this specification contains mostly calcium chloride. Specific heat and gravity changes with both salt content and temperature. For other conditions than those stated above, the chart results will be in error up to about 4%.

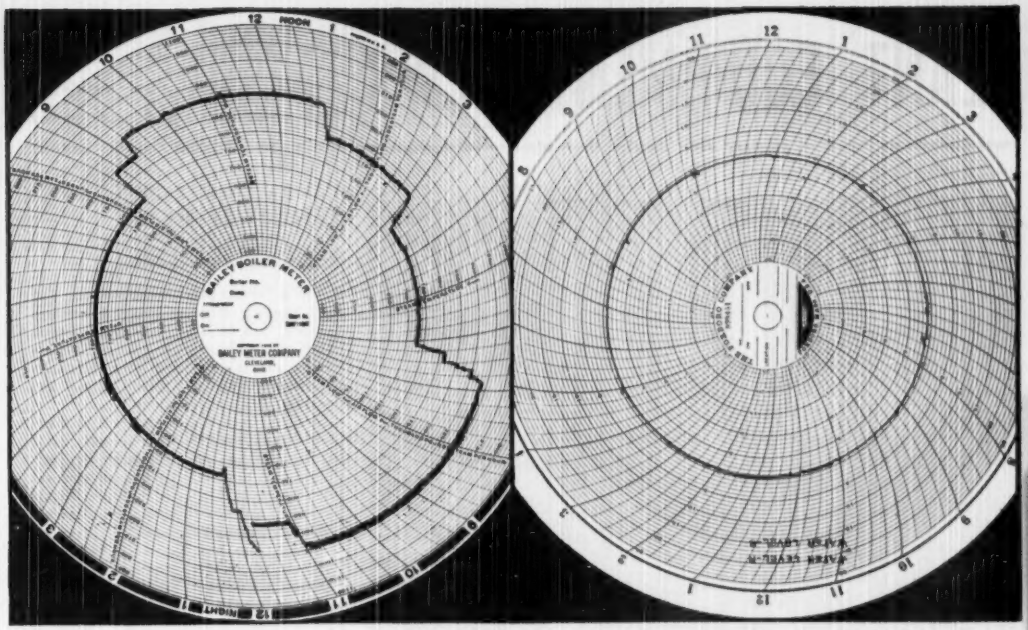
If you need exact figures, multiply the chart results by ratios of actual gravities and specific heats to the chart values. Formula for the chart:

$$\text{Tons} = \frac{\text{gpm} \times \text{temperature rise, F}}{28.56}$$

Example: A brine pump circulates 2000 gpm through a cooling coil, causing a 5-F temperature rise. How much refrigeration is produced in 24 hours?

Lay a straightedge, connecting 2000 on the gpm scale and 5 F on the temperature-rise scale. At intersection with the tonnage scale, read 350 tons.

TYLER G HICKS, *Summit, N. Y.*



Left: Steam flow from B & W Type FH Boiler rated at 275,000 pounds per hour, 900 psi, 910 F. Right: Drum level held within ±½ inch by COPES Flowmatic

The most important boiler plant in the world is yours

You hear a lot about one plant or another being important. But no other plant in the world is as important to you as the one for which you are responsible. All any other plant means to you is a chance to learn how to better your own.

Take the boiler from which the charts above were obtained. That it is one of the largest Babcock & Wilcox Integral Furnace Boilers ever built concerns you only because operating experience with it can help you with your own operation.

Study the charts carefully. How do your loads compare? Do you have such sudden sharp changes in rating? Is your drum level held as closely despite the changes? It can be —if your boilers, like this one, are equipped with COPES Flowmatic feed water control. And simple routine care by plant personnel takes care of all maintenance.

Write for Performance Report 487 on this public utility plant. It might help you better the world's most important plant—your own.

NORTHERN EQUIPMENT CO.
501 Grove Drive, Erie, Pa.

BRANCH PLANTS: Canada, England, France, Austria, Italy. *Representatives Everywhere*

COPES

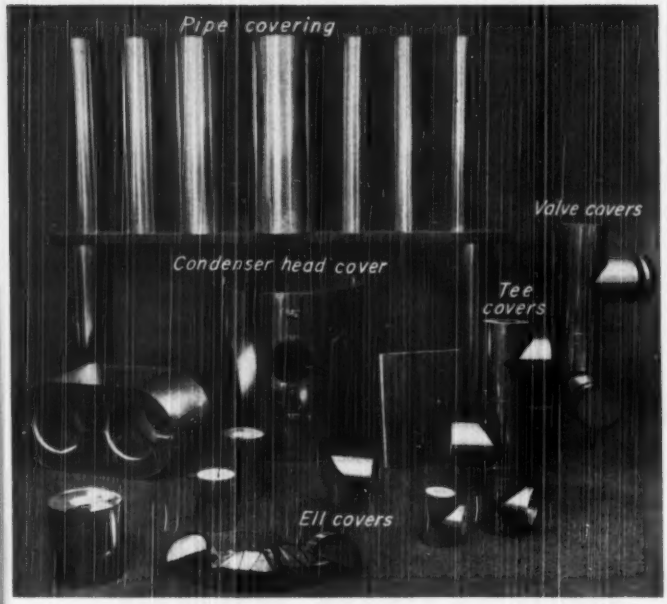
Headquarters for . . .

Boiler Feed Water Control . . . Excess or Constant Pressure Control, Steam or Water . . . Liquid Level Control . . . Balanced Valves . . . Desuperheaters . . . Boiler Steam Temperature Control . . . Hi-Low Water Alarms

PLANT EQUIPMENT NEWS

Published monthly as a service to readers

Your information center for new products to solve plant problems. Spot what you need, use handy cards to request more details



REFLECTIVE-METAL HEAT INSULATION

P500 • Mirror-heat insulation, for surfaces ranging from subzero temperatures to more than 1000 F, consists of several layers of medium-gage aluminum alloy sheets, mechanically held by nonconducting spacers to prevent metal contact and maintain uniform air spaces.

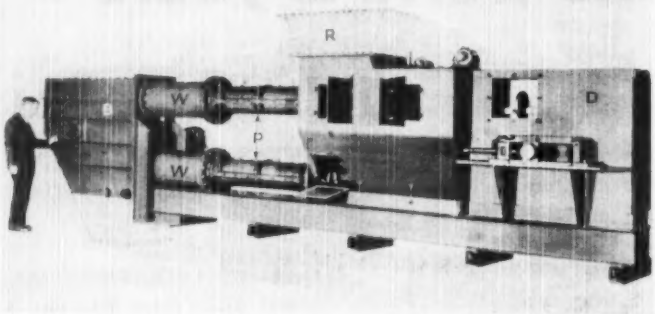
Sectional insulation snaps on pipe, clamshell fashion, and is secured with metal bands. Fittings are similarly handled. Plastic and tape-sealed joints on cold insulation stop infiltration of moisture. Mirror insulation also available for flat surfaces, tanks and irregular surfaces.

Makers claim heat loss is less than same thickness of standard commercial insulations.

Other advantages cited include dustlessness, extreme ease of installation, continued resistance to water, oil, rust, rot, fire, vibration, etc. Sections are light in weight and can easily be removed and replaced without tools.

Because the outer sheet forms its own finish, "Mirror" requires no paint, canvas or other protection.

Gronemeyer Corp, 203 South Road, Wilmington, Del.



CRUSHED-COAL FEEDER P550

Coal from a weigh scale to a pressurized boiler-furnace hopper is handled by a chain and circular flight assembly running in a closed circuit. Conveyor speed can be regulated to give close control of coal feed. Conveyor consists of a drive and takeup *D*, receiving section *R*, pneumatrols *P*, watercooled section *W*, and idler box *B*.

Pressure air goes into the hopper, and the coal feeds directly into the air stream. A vibrating plate feeder in the idler box can have its angle and stroke adjusted.

Between the idler box and pneumatrols a watercooled section reduces heat flow to the latter's seals.

Hapman Conveyors, Inc, 2405 W. McNichols Road, Detroit 21, Mich.

HYDRAULIC CYLINDERS P560

Complete standard-line high-pressure hydraulic cylinders from 1½- to 12-in. bores, for 2000- to 350-psi operation, have solid steel heads, caps and mountings. They meet all specifications and recommendations of the "Standards."

Miller Motor Co, 4027 N Kedzie Ave, Chicago 18, Ill.

ELECTRODE SLIDE RULE P561

Pocket-sized, comparator slide rule (Publication *GEN-37*) lists company electrodes, welding rods, with type of service for each. All principal manufacturers' electrodes, which are closest equivalents for the application, are also listed and keyed to AWS classification numbers.

G.E. Co, Schenectady 5, N. Y.

FLEXIBLE COUPLING P551

Ease of installation and large bore capacities feature couplings designed for motor- or engine-driven pumps, compressors, etc, of 50 to 1000 hp.

Couplings are available with several types of cushion materials, each adapted to a particular service indoors or out. As an

(*Continued on page 148*)

For further data on above items use reply cards on page 192a, identifying your request with letter *P* and number

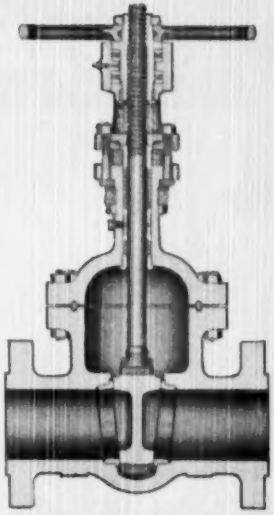
For the best in power piping...
Look to the complete CRANE line

STEEL VALVES FOR GENERAL STEAM SERVICES

You can count on Crane Cast Steel Wedge Gate Valves for dependable performance under the most severe service conditions. Straight-through ports minimize turbulence, erosion and resistance to flow. Long, close-fitting disc guides assure tight seating.

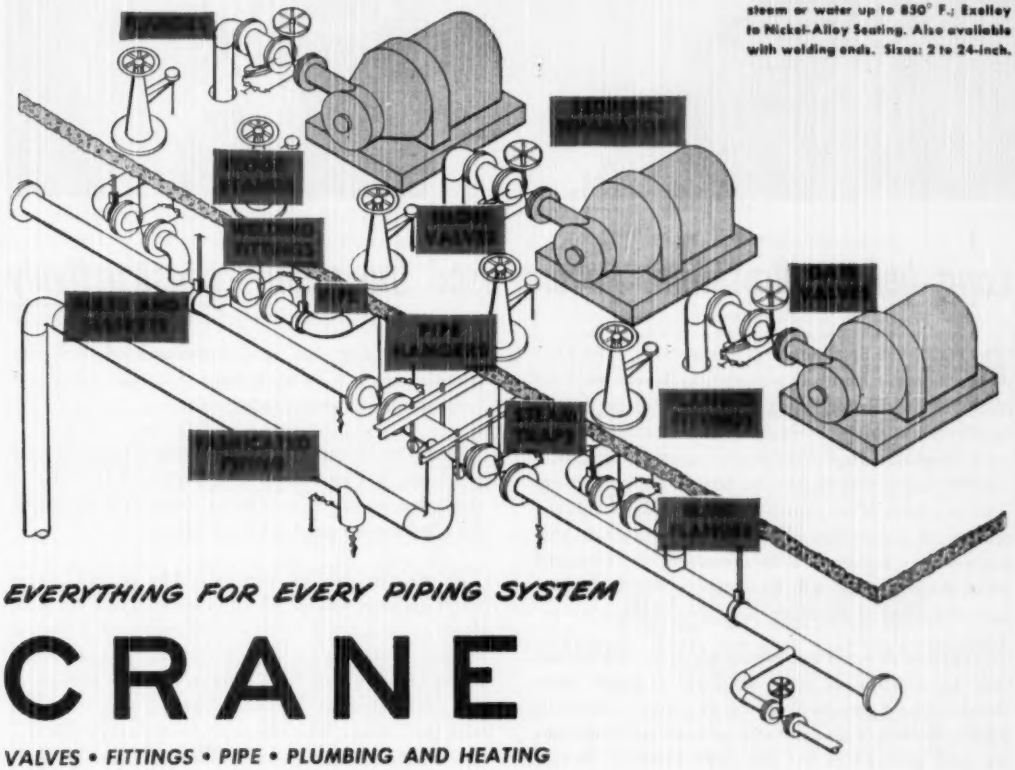
Strong tee-head disc-stem connection, easily lubricated yoke bushing, and ample bearings provide smooth operation. Made of Carbon or Alloy Steel suitably trimmed for pressures and temperatures up to 2500 pounds at 1000°F. Available with flanged, screwed, or welding ends. See your new No. 49 Crane Catalog.

CRANE CO., 836 S. Michigan Ave., Chicago 5, Ill.
Branches and Wholesalers Serving All Industrial Areas



No. 76XR, 600-Pound Steel Gate. For steam or water up to 850° F.; Exalloy to Nickel-Alloy Seating. Also available with welding ends. Sizes: 2 to 24-inch.

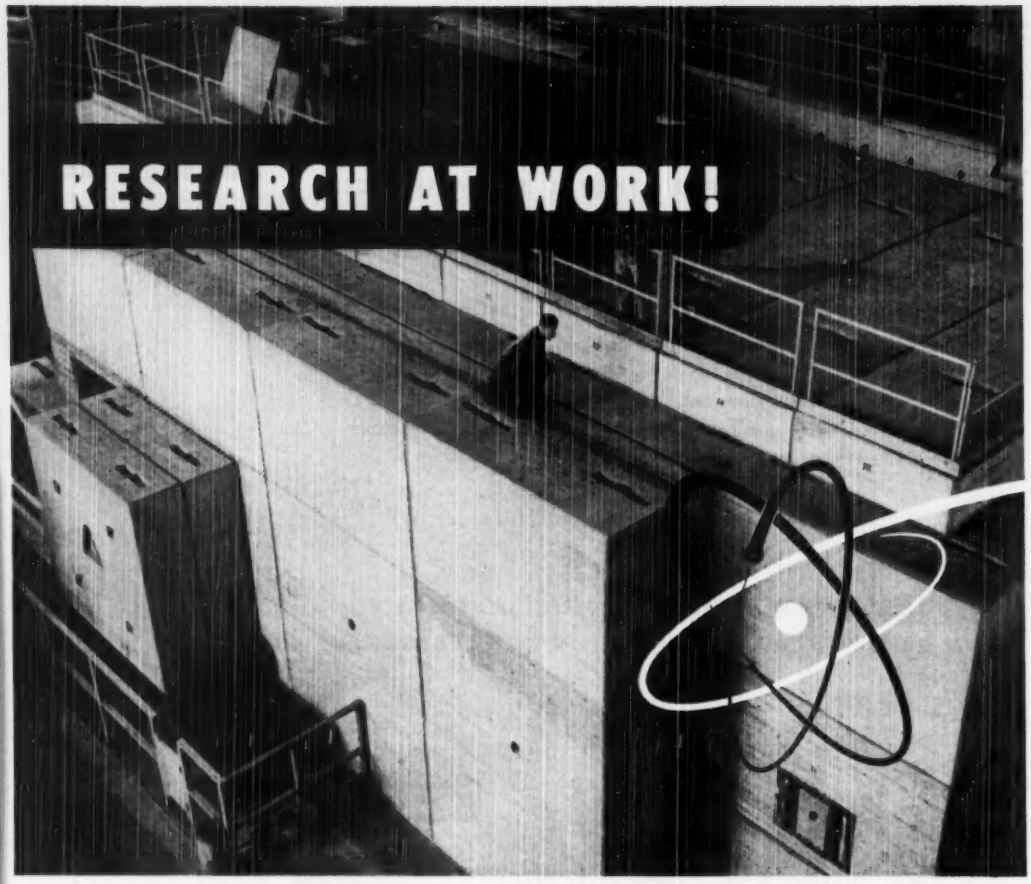
THIS STEAM TURBINE PIPING INSTALLATION CAN BE 100% CRANE ON ONE PURCHASE ORDER



EVERYTHING FOR EVERY PIPING SYSTEM

CRANE

VALVES • FITTINGS • PIPE • PLUMBING AND HEATING



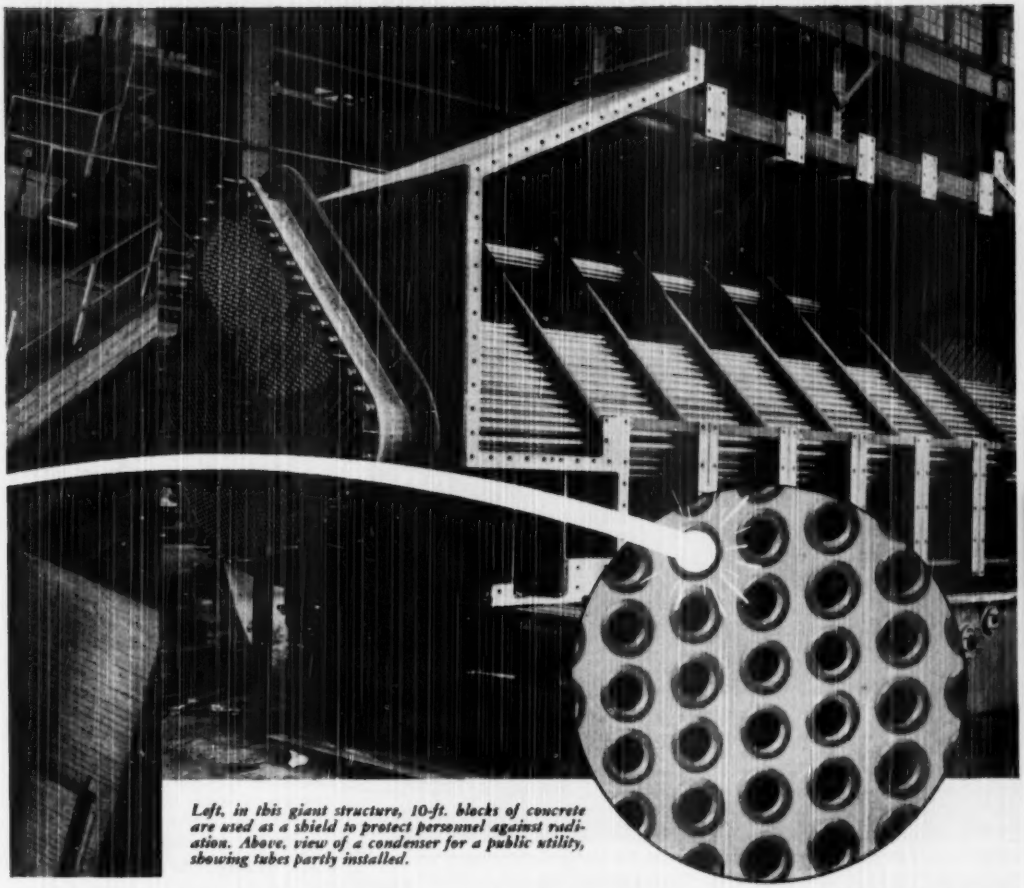
Long before Hiroshima, Revere used the atom — constructively

BEFORE the first atomic pile was built, before the first atomic bomb was exploded, Revere used the effects of the disintegrating atom for constructive research. It was in 1941 that radio-active tracer elements were employed in a Revere-sponsored investigation into the destructive process known as dezincification. This is a form of corrosion formerly of chief concern to users of copper-zinc alloy condenser tubes. In this process the alloy seems to be dissolved from localized areas, the zinc going off in solution while the copper is re-deposited as a porous plug.

A number of years ago it was found by experiment that the addition of small amounts of some other element would prevent or inhibit this electro-chemical action. Nobody knew just why or how, nor what was the best percentage for the third element. Revere decided to find out, and commissioned two able scientists in a famous Eastern technical school to conduct the necessary experiments.

In this work, radio-active elements or isotopes were produced in a cyclotron, and were used in order to determine the function of those elements in rendering the alloy more resistant to corrosion.

Briefly, the method was this: The desired radio-active element was dissolved in an acid, and the solution's radio-activity calibrated by means of a Geiger counter. A standard sample of the alloy was immersed in the solution, and from time to time the amount of the active element deposited upon it was measured with the counter. The nature of the deposited film was also checked by the electron diffraction method. This



Left, in this giant structure, 10-ft. blocks of concrete are used as a shield to protect personnel against radiation. Above, view of a condenser for a public utility, showing tubes partly installed.

was in effect an accelerated test for dezincification and its inhibition. It was repeated many times with solutions of various concentrations. This, mind you, was in 1941, before radio-active tracer procedures were of any interest except to a comparatively few scientists.

The conclusions reached as a result of these tests can be summarized as follows: The corrosion of uninhibited copper-zinc condenser tubes occurs by solution of the alloy as an entity. When an inhibitor is present, however, in the percentages revealed by the experiments, the inhibitor is re-deposited on the alloy as a film which has about the same effective electrical potential as copper. The deposition of copper is thereby prevented. One of the key processes in dezincification having been thus interrupted, the process itself is effectively stopped, or at least so reduced in activity as to provide corrosion resistance, and commercial service, for extremely long periods of time. Thus the inhibited copper-zinc alloy condenser tube has become reliable and economical to an extent heretofore unrealizable.

Realistic Revere Research

Often the word "research" is thought to mean startling new discoveries and swift, amazing inventions. The fact is, however, that research does not work that way. Such modern devices as the automobile, the airplane, the telephone, radio, television, and numerous others would indeed be startling if they had been developed overnight. As we all know, they have reached their present high degree of development as a result of continuous improvement, detail after detail, problem after problem being worked out through countless hours and even years of the most painstaking research.

Revere's research is of that type. It is a continuing search for better knowledge of its materials and processes, and the way its metals may be utilized with the greatest efficiency and the maximum economy. This is not spectacular, but over the years it has made many contributions to the farm, the home, and industry.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

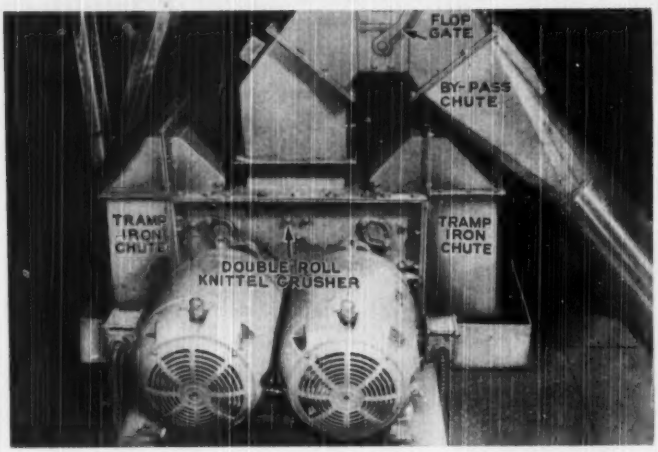
230 Park Avenue, New York 17, New York

Mills: Baltimore, Md.; Chicago, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y. Sales Offices in Principal Cities, Distributors Everywhere.

example, one uses oil-resisting neoprene protected by bronze. It's designed for use where oils, chemicals, ozone and heat would deteriorate ordinary cushions rapidly.
Lovejoy Flexible Coupling Co, 5001 W. Lake St, Chicago 44, Ill.

SHAFT SEAL **P515**

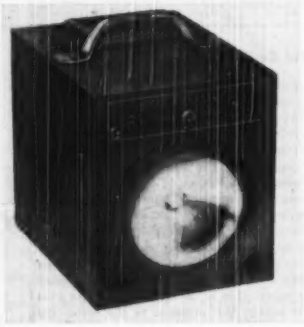
Repsco rotary-shaft seal is fabricated to fit any pump without costly alterations, is easily installed, compensates for end thrust and misalignment.
Republic Supply Co, Houston, Tex.



COAL CRUSHER **P535**

Two rotors driven by separate, direct-coupled motors feature the *S-A Double-Rotor Knitted Crusher*. Synchronization is not necessary because the crushing sections operate independently. This is an important feature.

Unit is said to give the same horsepower per ton ratio with wet coal as with dry. Crusher splits the coal on initial impact, then crushes it on breaker plates. Sized slots in the crusher-grate bars set the top size of the material.
Stephens-Adamson Mfg Co, Aurora, Ill.



EMERGENCY LIGHT **P562**

Emergi-Lite provides a light source that operates automatically upon failure of current supply. Unit consists essentially of 6-v 40-amp-hr storage battery, 6-v sealed-beam light, transformer, selenium rectifier, relay, double-pole, double-throw toggle-switch and pilot lamps.

During normal operation, unit is plugged into a source of 110-v ac, and toggle switch is in standby position. Battery is now being charged at a low rate, or trickle charged. Upon failure of power supply, relay operates to turn on the 6-v lamp drawing current from the battery. Lamp remains lighted about 9 hours, or until power returns.
Alliance Electric Works Ltd, 141-153 Bates Rd, Montreal 8, Quebec.

WATER-REPELLENT COATING P538

Ranetite No. V transparent coating, containing Poly-Siloxane resin, gives outside above-grade masonry walls a transparent coating which is impervious to water and dampness. Prices are $5.50 per gal in one- and 5- gal cans, and $5.25 per gal in 55-gal steel drums.
The Ranetite Mfg Co, Inc, 1917 S. Broadway, St. Louis 4, Mo.

CONTROL VALVE **P511**

Atlas No. 235 adjustable lift-opening lever-operated control valve provides an easy method of fixing the valve lift at the required position within range of the valve movement. Valve is equipped with a flexible cam sheet attached to cam arm, which is rotated by a lever. Curvature of cam sheet is adjusted by a series of setscrews.

(*Continued on page* 150)

Check These, Too . . .

. . . **Motor-Gear Unit** combining an electric motor and a 4-speed transmission.....page 174

. . . **Large-Volume Blower** that's vibration free and can be direct- or V-belt driven. Typical is the case of two 3600-rpm blowers with 50- and 60-hp motors, put out 6000 and 7500 cfm respectively.....page 176

. . . **I-D Boiler Fan** has a divided housing with the motor in an isolated asbestos-lined chamber, around which flue gas is bypassed....page 176

. . . **Variable-Speed Motor** featuring forced-draft ventilation from an external fan protected by a streamlined fan cover.....page 178

. . . **Mobile Platform** that one man can operate to a maximum height of 17 ft. Manual hydraulic pump gives full elevation in 2 min.....page 182

. . . **Pressure-Fed Paint Brush** has hose connected to handle. Paint is delivered under 20 to 30 psi to a feeder brush set within the main brush.....page 184

. . . **Portable Pipe Threader** in several models to handle between ⅛- to 8-in. pipe. All have a ½-hp universal motor.....page 184

. . . **Wet-Water Blender** for introducing wetting agents into a flowing stream of water to reduce surface tension and give it greater wetting power and penetration.....page 186

. . . **Self-Powered Pump** classified as simplex, single-action reciprocating pump whose power end has a reversing mechanism or valve gear. Valve operates an auxiliary liquid or air piston that drives the pump from a power supply through the main reversing valve.....page 188

. . . **CO_2 Recorder** that provides a continuous measurement of very low concentrations of carbon monoxide in air.....page 190

. . . **Air Diffuser** that is a combination supply and exhaust unit. Ceiling outlet is supplied in a gray or aluminum finish.....page 190

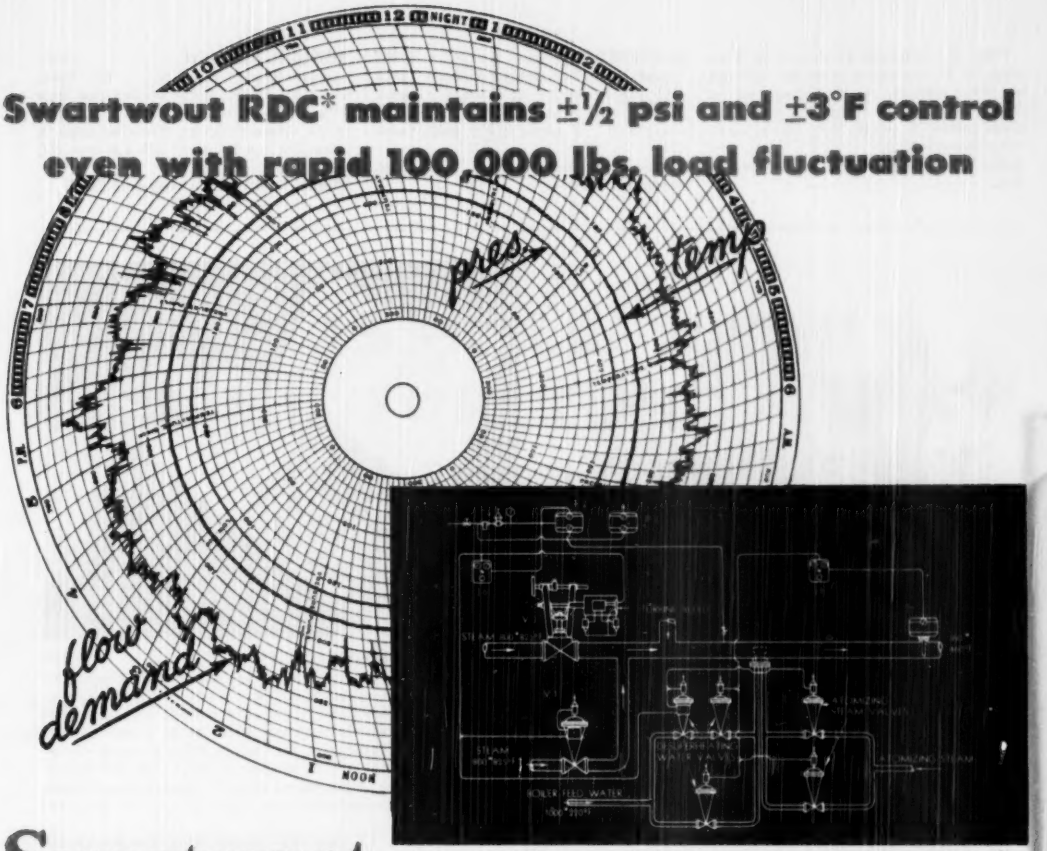
. . . **Fire Extinguisher** built in 500-, 1000- and 2000-lb capacities for protecting wide areas where minimum manpower is available.....page 192

And Next Month . . .

. . . **Governor** for small hydraulic turbine. Unit was developed for use where smallest governor previously made had been too large and expensive for this type installation.

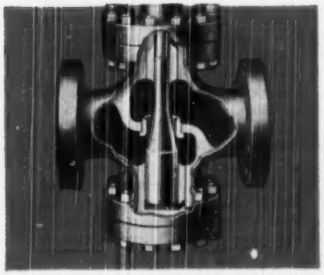
For further data on above items use reply cards on page 192a, identifying your request with letter P and number

Swartwout RDC* maintains ±½ psi and ±3°F control even with rapid 100,000 lbs. load fluctuation

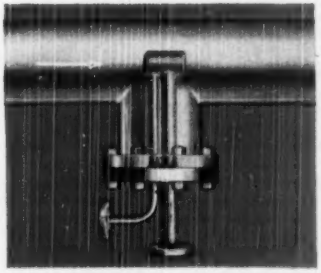


Swartwout
POWER PLANT EQUIPMENT

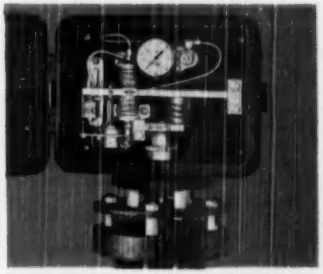
1 Swartwout RDC* system — Reducing, Desuperheating and Controls — handles fluctuating make-up load of up to 250,000 lbs. steam/hr. in a large Eastern paper mill. Initial conditions, 800 psi and 825°F; required final conditions, 160 psi and 460°F. Chart shows how Swartwout RDC system holds pressure to ±½ psi, temperature to ±3°F from minimum to maximum loads.



2 Swartwout V-1 valve *(above)* handles first 50,000 lbs. of load; V-3 then cuts in to handle 200,000 lbs. additional load. Valves reduce pressure from 800 to 160 psi without turbulence, vibration or undue noise. Correct design of disc, seat and throat eliminates high-velocity impingement and other destructive forces common to conventional reducing valves.



3 Swartwout steam atomizing desuperheater drops live steam temperature from 825°F, and varying extraction temperatures, to 460°F without pressure loss. Smooth-finished nozzle passages disperse atomized water outside head so that no erosion occurs. Narrow-angle atomization prevents thermal strains or cracks in piping, eliminates need for pipe liners.



4 Swartwout T2 direct-contact master control with reset for load compensation, sends temperature-proportional air-loading pressure through J-6 manual-automatic selector panel. Response to temperature change, within fraction of a second, assures precise temperature control regardless of load fluctuation or time lag.

A-0789

SEND FOR BULLETINS S-21-E, S-22-C, S-198 • THE SWARTWOUT COMPANY, 18511 EUCLID AVENUE, CLEVELAND 12, OHIO

Seats are furnished in steps of 1/16-in. diameter in single-seat valves and in steps of ⅛-in. diameter in double-seat valves. Valve disks are furnished with restriction plugs having the correct taper for the maximum flow specified.

Atlas Valve Co, 282 South St, Newark, N.J.

SCAFFOLDING P501

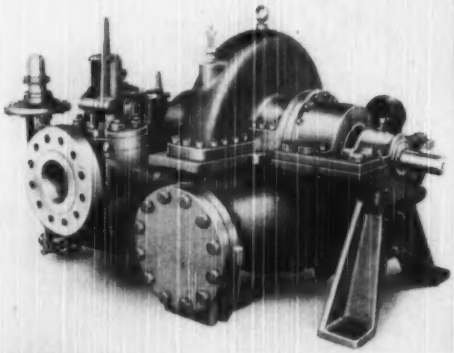
Aluminum-alloy tube-and-coupler scaffolds can be erected in any size or shape. Swivel base plates require no wedging. Carry over 75 lb per sq ft with safety factor of 4.

Up-Right Scaffolds, 1013 Pardee St, Berkeley, Calif.

TORQUE WRENCH P512

Proto torque wrench has a trip lever, set at the desired torque reading that trips a signal trigger when the wrench is pulled to the torque limit set. Wrenches come in capacities from 25 to 300 ftlb and from 300 to 3600 in.-lb.

Plomb Tool Co, Los Angeles, Calif.



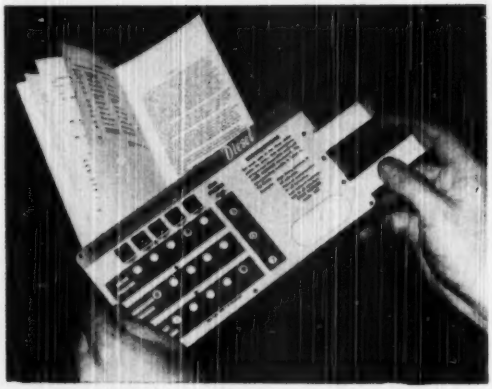
SINGLE-STAGE, HIGH-PRESSURE TURBINE P556

Mechanical-drive turbine that handles pressures to 1450 psi, initial temperatures to 950 F and backpressures to 300 psi. Unit has labyrinth shaft seals; a series of shaft grooves and mating tongues of stainless-steel packing.

Turbine is supported on true center line while front end is mounted on a flexible channel. These features take care of extreme thermal expansion met in high-temperature service. Mounting method permits both radial and axial expansion without disturbing shaft center line.

Unit is made in three sizes for capacities up to 200 hp.

De Laval Steam Turbine Co, Trenton 2, N.J.



DIESEL TROUBLE-SPOTTER P557

Firing pressure, compression pressure and exhaust temperature form the basis for operation of the *Schweitzer Trouble-Spotter*. After noting whether these factors are normal, high or low in each cylinder, three sliding inner strips in the *Trouble-Spotter* can be juggled to correspond. Moving the strips to match operating conditions causes a code number to appear on the *Spotter*.

This code number is then looked up in the *Guide* giving probable trouble causes. *Trouble-Spotter* and *Guide* go hand in hand and sell for $3.

Edward M Power Co Inc, 602 Granite Bldg, Pittsburgh 22, Pa.

FLOAT CONTROLLER P508

No. 65 explosion-proof float-operated electric controller has been tested and approved by underwriters for use in Class 1, Group C atmospheres containing ethyl-ether vapors, ethylene, or cyclopropane. Also Class 1, Group D atmospheres containing gasoline, petroleum, naphtha, butane, etc.

Float chamber is heavy cast iron, float is copper, float rod is brass with bronze bellows. Maximum body pressure is 40 psi. Device is of packless construction, and the wiring and terminals are totally enclosed.

McDonnell & Miller, Inc, Wrigley Bldg, Chicago 11, Ill.

PLUG VALVE P514

Honeywell cylindrical plug valves are nonlubricated, leak-tight, suitable for steam, fuel oils, caustic solutions, viscose, beer mash and other fluids. Standard units are from ½ to 6 in., and other sizes are available. Can be had in straight-through, 3-way or 4-way bodies. Valves can be supplied in high-tensile iron, bronze, stainless steel, *Ni-resist Duriron*, and other alloys to suit operating conditions. Connections are screwed, in sizes from ⅛ to 2 in., and flanged in sizes from 1 to 6 in. According to body material, pressure ranges from 150 to 300 psi, and temperatures from 360 to 750 F.

Minneapolis-Honeywell Regulator Co, Belfield Valve Div, Broad St at Hamilton, Philadelphia 23, Pa.

FLAME SAFEGUARD P536

Fireye system FF-1, consisting of a photoelectric scanner, 45PH5, and programming control 24PJ8, provides complete flame-failure protection for commercial gun-type light-oil burners. In a light-off failure, lockout occurs 5 sec after power has been applied to motor and ignition. If failure occurs during operation lockout takes place within 2 to 4 sec.

Combustion Control Corp, 77 Broadway, Cambridge 42, Mass.

TWIN-SHELL BLENDER P520

Two cylindrical shells of equal diameter, joined together to form a V, make up the *P-K Twin Shell Blender*, a mixing apparatus, for blending dry materials.

Unit rotates about a horizontal axis, passing through about the geometrical center. There is a dust-tight discharge valve at the point of the V. In operation the blender is set in upright position and charged through either or both ends. It rotates for a desired time; is set upright again; mixed product is unloaded.

Patterson-Kelly Co, Inc, 56 Burson St, East Stroudsburg, Pa.

SOLDERING TORCH P531

Half-pint self-pressure torch, No. 59 for gasoline and No. 60 for alcohol, is of high-polished, heavy-gage brass, 3½ in. diameter. It holds 7½ ounces of fuel, burns 3½ hr full open at 1700-F temperature. A brass wire, interwoven with the wick, feeds fuel so no pump is needed.

Turner Brass Works, Sycamore, Ill.

REVOLVING JOINT P552

Cartridge-type revolving joint requires no bearings, lubrication or flexible hose. It is used in industries where there is heating or cooling of drum rolls such as dryers, slashers, dry cans, and calender mills. The

For further data on above items use reply cards on page 192a, identifying your request with letter P and number

It was 1912 — and dances like the "Turkey Trot", "Bunny Hug" and "Fox Trot" caught the public's fancy — when we introduced "Flexitallic", the *original* Spiral-Wound Gasket, and opened to Industry new fields of opportunity in the confining of fluids at high pressures and temperatures.

"WHAT IS THE RIGHT GASKET FOR THIS JOB?"

Every Flexitallic Spiral-Wound Gasket is engineered from the ground up for operation at specified temperatures and specified pressures—and to meet particular conditions of thermal and physical shock, corrosion, vibration, or unusual joint stress.

The basic Flexitallic principle—the spiral winding of V-crimped spring-like metal plies alternating with plies of filler—lends itself to almost unlimited variation in material and structure to meet the varying demands of use.

The physical and chemical properties of the metal, the type of filler, the relationship of filler to metal in the winding—all these are variables in the hands of the Flexitallic engineer who is designing a Flexitallic Gasket for a specific use.

Using the most precise instruments for the determination of yield values, resilience and gasket density, the Flexitallic engineer builds each Flexitallic gasket to an exact standard of performance.

Many Flexitallic Gaskets—originally designed as "specials" for oil refineries, chemical industries, power plants, shipyards, ship operating companies—are now "standard" gaskets in the Flexitallic line.

If safe sealing is of serious concern to you, give us these facts on your gasketing requirements: (1) Fluid to be confined; (2) Type of flange and dimensions; (3) Operating pressures and temperatures; (4) Bolting data.

In return we will send you a genuine Flexitallic Spiral-Wound Gasket. Test it severely—in your laboratory or on the job. The results will show you why most industries in the high-pressure, high-temperature field are standardized on Flexitallic Gaskets.

FLEXITALLIC GASKET COMPANY
Eighth and Bailey Streets, Camden 2, N. J., U.S.A.

The name "Flexitallic" is the registered trade mark identifying the *original* (patented) Spiral-Wound Gasket. Now—for your protection and ours—this trade mark FLEXITALLIC is stamped into the outer ply of every *genuine* Flexitallic Gasket. Your guarantee of quality.

joint provides an effective seal for air, steam, oil, gas, water and other fluids.

Misalignment is corrected by the ball-seat arrangement. Joints are brass in ½, ¾ and 1 in. sizes.

Rothern Engineering Co, 4911 Irving Park Road, Chicago 41, Ill.

ADSORBENT REACTIVATION P534

Reversible fan or blower provides a simple method of reversing flow of gas or air when changing from a reactivating to a cooling cycle in the use of solid adsorbents as dehumidifiers.

Heretofore a unidirectional fan or blower along with large and expensive reversing valves and ducts had to be used. In this way the air or gas for cooling in *Lectrodryer* equipment can be put through a closed cycle, and not introduce additional moisture into the system.

Pittsburgh Lectrodryer Corp, PO Box 1766, Pittsburgh 30, Pa.

LIGHTING PANELBOARD P563

Line of narrow-width NMO-XX circuit breaker lighting panelboards to fit into web of 8-in. wide-flange structural beams. Panelboard incorporates thermal-magnetic circuit-breaker units that "plug-in" on cylindrical bus bars.

Available both for single-phase 3-wire, and for 3-phase 4-wire services with 15, 20, 30, 40 and 50 amp branch circuits.

Square D Co, 6060 Rivard St, Detroit 11, Mich.

THERMAL INSULATION P564

Three tough, permanently separated aluminum sheets, and two fiber, flame, mold and vermin-proof partitions make up Infra Type 6 thermal insulation. This insulation provides six reflective spaces and six reflector surfaces of an emissivity and absorption of only 3%.

Insulation can be installed in ceilings and floors, between beams, girders, trusses. It requires no special skill with a speed of 2000 sq ft a day easily possible.

Infra Insulation, Inc, 10 Murray St, New York, N. Y.

ION EXCHANGER P573

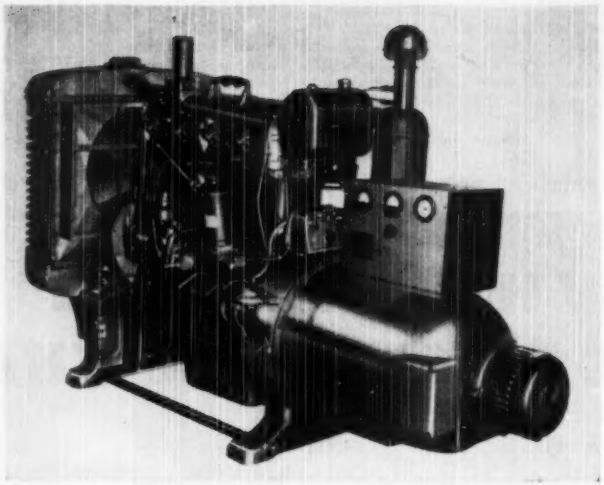
Deeminizer mixed-ion exchanger weighs only 5½ lb and requires only 1/3 sq ft of bench space. Capacity is 5 gph of water equal in ionic quality to triple distilled water. Can deliver water that has an electrical resistance of 10 million ohms or that contains only one part of ionic solids per 100 million parts of water.

Crystal Research Laboratories, Inc, Hartford, Conn.

EASY-PACK VALVE P518

Fig. 444 series globe and angle stop valves are available in 600- and 1500-psi static-pressure classes. Valves are drop-forged steel and can be had with either bolted or union bonnets and with screwed or socket welding ends. Valve is OSY type with bolted glands for easy packing.

Edward Valves, Inc, East Chicago, Ind.



DIESEL GENERATOR P589

Five new models of diesel-driven electric-generating plants, equipped with automatic-voltage regulators and ranging from 12½ to 55 kw. Powered by International Harvester low-speed engines, these new units combine all-weather gasoline-engine starting with full diesel operation.

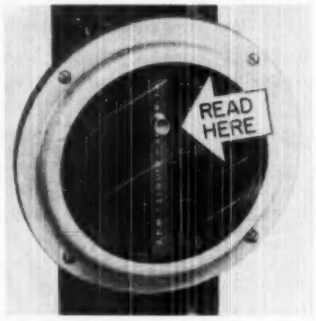
Engine is cranked by 12-v starting system. Less than a minute of warm-up is required before changing over to full diesel operation — by control lever. Battery-recharging generator is provided to maintain starting batteries at full charge. Available in all standard voltages, frequencies and phases.

D W Onan & Sons, Inc, Minneapolis, Minn.

UNIT HEATER P524

Self-contained, fully automatic, gas unit heater has easier accessibility for servicing; is more compact in space requirements being 16% shorter; is finished with Perlite, a soft, neutral gray-green metallic paint that has a heavier, more durable, protective coat than ordinary paints produce.

Reznor Mfg Co, Mercer, Pa.



FLOW GAGE P577

Magna-Sight flow gage consists of a short body with flanged or screwed pipe connections. It accommodates a fixed orifice in the lower end. A tapered metering plug rises and falls with fluid flow rate in accordance with variable area metering principles. Metering plug carries a permanent magnet and a hollow, cylindrical, soft-iron follower rides in an external slot.

Available in brass, bronze, iron, steel and type 316 stainless steel. Sizes from ¾ to 4 in. with maximum capacities of 3.5 to 250 gpm. Can be used for clear and opaque liquids, slurries and other fluids. All temperatures up to 400 F and pressures up to 500 psig can be accommodated. Accuracy averages about 5% over the scale range.

Fischer & Porter Co, 96 County Line Road, Hatboro, Pa.

COMPRESSORS P505

Trailer-mounted compressor is designed especially for operating small air tools or miscellaneous service jobs. Has ample capacity for operating paint-spray guns, chipping hammers, light paving breakers, and similar pneumatic tools. Compressor is driven by a gasoline engine through V-belts. Unit is equipped with semi-pneumatic rubber-tired roller-bearing wheels, trailer hitch and stabilizer leg. Three sizes are available.

Gardner-Denver Co, Quincy, Ill.

FLOW CONTROLLER P544

Veriflow meter and *Veritrol* indicates and controls corrosive liquids without using weigh tanks, orifice plates or gage sticks. Measurement is by volumetric principle.

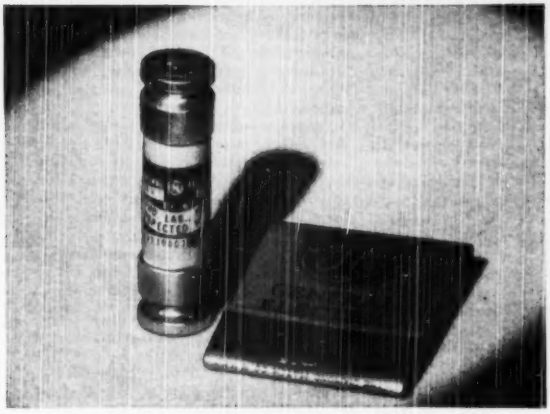
(*Continued on page 174*)

For further data on above items use reply cards on page 192a, identifying your request with letter P and number

NEW! NEW! NEW! NEW! NEW!

250 AND 600 VOLT FUSES

INTERRUPT 100,000 AMP!



Type EJ-6 fuse rated 250 volts a-c, 30 amperes (actual size)

...AND THEY'RE LISTED BY UNDERWRITERS' LABORATORIES

These new General Electric Type EJ-6 current-limiting power fuses are for application on 600-volt a-c (and below) circuits where the short-circuit current may reach 100,000 amperes. You get increased protection when you use EJ-6 fuses.

RATINGS Standard NECS size fuses are available in 30, 60, 100 and 200 ampere sizes in both 250- and 600-volt ratings. All ferrules and blades have silver surfaces to reduce contact losses. Fuses will interrupt 100,000 rms amperes total asymmetrical current including the d-c component of fault current.

FUSE CLIPS The new EJ-6 fuses are designed to fit standard NECS fuse clips. Also available are special-design clips that prevent the insertion of other NECS fuses. Short-circuit stresses cannot jar fuses loose from these clips. Protect your equipment and personnel by allowing only fuses of high interrupting capacity to guard your circuits.

For additional information on these new fuses ask your G-E Sales Representative for a copy of publication GET-1819 or use the handy coupon. *Apparatus Dept., General Electric Co., Schenectady 5, New York.*

Section CB56-30
Apparatus Department
General Electric Company
Schenectady 5, New York

Please send me your bulletin, GET-1819, that describes the new Type EJ-6 Current-limiting Power Fuse.

Bulletin needed for: .....Reference purposes .....Planning immediate project

NAME.....
(Please Print)

POSITION.....

COMPANY.....

CITY..... ZONE..... STATE.....

GENERAL ELECTRIC

ENGINEER'S BOOKSHELF

REVIEWED IN THIS ISSUE

STEAM AND GAS TURBINES • INTRODUCTION TO THE GAS TURBINE
THEORY AND DESIGN OF GAS TURBINES, JET ENGINES • REFRACTORIES
DETERMINATION OF OXYGEN IN DEAERATED WATERS • RIGGING HANDBOOK
NIAGARA CONTROLLED-HUMIDITY METHOD • WELDING HANDBOOK
MACHINE TOOLS FOR ENGINEERS • OIL BURNERS • HYDRO HANDBOOK
HEAT PUMP APPLICATIONS • AUTHOR'S GUIDE
TECHNIQUES OF PLANT MAINTENANCE • INDEX OF NOMOGRAMS

Steam and Gas Turbines

STEAM AND GAS TURBINES (1950), *by B G A Skrotzki, associate editor of Power, and W A Vopat, professor of mechanical engineering, head of department, Cooper Union School of Engineering.* 395 *pp*, 6x9, 358 *illust, tables, cloth.* $5. *McGraw-Hill Book Co,* 330 *W* 42*nd St, New York* 18, *N.Y.*

An introduction to the practical field of steam- and gas-turbine operation and maintenance. First eight chapters are devoted to all forms of steam turbines, the ninth and last chapter, forming 20% of the book, discusses gas turbines and their practical forms.

The theme centers about turbine behavior as applied to stationary power generation. Theory, as the practical operator needs to know it, is built up from elementary forces making a windmill turn. Mathematics and advanced design considerations, however, have been minimized as much as possible. All forms of steam turbines, from small auxiliary drives to giant central-station types, are illustrated.

After reviewing turbine assemblies all individual parts are critically discussed. There are separate chapters on lubrication, operation and maintenance, governors and turbine auxiliaries. One chapter devoted to steam fundamentals briefs the novice on steam properties, how to use them in figuring turbine performance.

Gas turbines included in the book range from the 160-hp Boeing unit to the 27,000-kw Brown Boveri unit. All types of cycles are covered including closed and free-piston compressors. Practically all material in Power's famous special sections on *Steam Turbines,* Dec 1945, and *Gas Turbines,* Oct 1946, is included.

Welding

WELDING HANDBOOK *(third edition) American Welding Society,* 1650 *pp*, 6x9, *illust and indexed, cloth,* $12. *American Welding Society,* 33 *W* 39*th St, New York* 18, *N.Y.*

This most complete and authoritative source of welding information, just released, represents the experience of over 250 experts and four years of compilation. It is meant to be equally useful as a text on welding and as a reference book. Data suggested by a nation-wide survey of users are included.

Twenty-seven chapters cover more than 30 welding and cutting processes in industry today. Information on each process covers equipment used, basic operating principles and application of process for different metals and industrial applications.

Thirteen chapters contain material on ferrous and nonferrous metals commonly welded, including their general properties, how to weld them with different processes and their use by different industries.

A group of eleven chapters discusses design, material, workmanship and inspection requirements for industrial applications, such as aircraft, bridges, buildings, etc.

Additional chapters are devoted to data for estimating costs, physics of welding, welding metallurgy, a dictionary of welding terms and definitions, plus general engineering tables for shop and office use.

Machine Tools

MACHINE TOOLS FOR ENGINEERS, *by Charles R Hines, assistant professor, manufacturing process, Rensselaer Polytechnic Institute.* 355 *pp*, 6x9, *illust and indexed, cloth,* $3.50. *McGraw-Hill Book Co,* 330 *W* 42*nd St., New York* 18, *N.Y.*

First of two volumes on manufacturing processes evolved from courses at Rensselaer Polytechnic Institute. It is aimed at introducing the student to the fundamentals of machine tools. And from them to manufacturing and production processes so he has basic background to build on.

Stress is on machine tools as production devices. Approach is considerably different from that of the usual book for machinists. The engineering student's prime interest is in a machine's production possibilities. The machinist is concerned chiefly with developing a skill.

Described and analysed are all types of machine tools, how they are used, what they can do, and what their limitations are. Also brought out are ways product design is affected by the machine tools available.

Hydroelectricity

HYDROELECTRIC HANDBOOK (*2nd edition*—1950). *Edited by William P Creager, consulting engineer, and Joel D Justin, consulting engineer.* 1151 *pp*, 6x8½ *in.*, 600 *illust, many tables and charts.* $12.50. *John Wiley & Sons,* 440*-4th Ave, New York* 16.

After being out of print several years this well-known handbook is again available. It is the work of two editors and 19 contributors, all outstanding hydraulic engineers. Since the first edition in 1927 great strides have been made and essential data accumulated on the design of hydroelectric power developments. So most material has been rewritten, and 254 pages added.

Even with this added space it was impossible to include a complete exposition of designing methods of all structures necessary for hydroelectric-power developments. But enough information is presented to give an accurate picture of problems involved and to provide data for preliminary designs, cost estimates, and reports.

The 44 chapters are grouped in four divisions: preliminary studies and economics; dams—designs and construction; conduits and powerhouses; equipment and operation. First division covers investigation and planning of hydroelectric projects, treating such topics as rainfall, evaporation, runoff, river gaging and floods. Various types of hydroelectric plants are described and the economic factors in their operation explained.

Second and third divisions compare dams and present general design methods. Special features of dams include spillways and intakes, conduits, canals, tunnels. Last division deals with mechanical and electrical equipment of hydroelectric plants and operating methods. Electrical design, hydraulic turbines, generators, transformers and transmission lines are treated.

Oil Burners

OIL BURNERS *(revised, second edition), by Kalman Steiner, consulting engineer.* 502 *pp*, 6x9, *cloth, illustrated and indexed,* $6.50. *McGraw-Hill Book Co,* 330 *W* 42*nd St, New York* 18, *N.Y.*

A completely rewritten second edition of a manual designed to bring an up-to-date, thorough treatment of fuel oil, oil burners and oil burning. Here's a book that gets down to details designer, installer, service man and user want to know. The burners so covered range from the domestic through the commercial to the industrial unit.

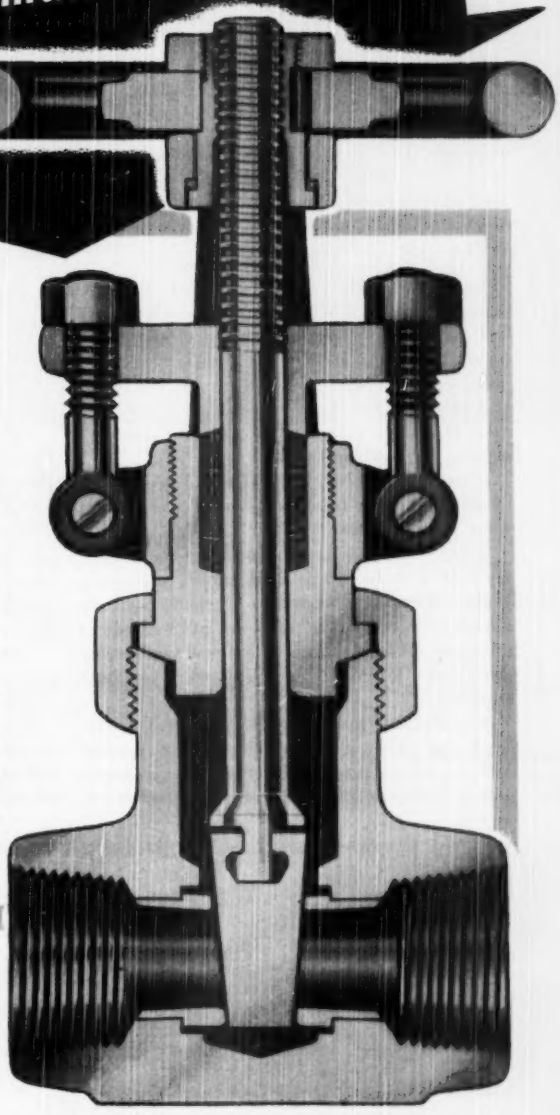
Underlying theory as well as current practice are reviewed. Just how oil burners can be most effectively used, what their maximum effectiveness is are typical of some questions answered. Considerable information on electronic controls, refractories, boiler capacities, building temperature controls and fluid flow come in for discussion.

Controlled Humidity

ENGINEERING DATA ON THE NIAGARA CONTROLLED-HUMIDITY METHOD, *by Niagara Blower Co,* 52 *pp*, 8½x11, *paper,* $2.50. *Niagara Blower Co,* 405 *Lexington Ave., New York* 17, *N.Y.*

(Continued on page 192)

Here's Why You Get Lower Maintenance Costs with Chapman List 960



1. *Gaskets!*
Available with either metal to metal or gasketed joint as required.

2. *50% Stronger!*
New design features compensate at points where excessive strain can develop . . . make stem and wedge gate connection 50% stronger than before.

3. *Wear-Resisting Wedge Faces!*
To keep your maintenance cost down the wedge faces are hardened to 800 Brinell by the exclusive Malcomizing process.

4. *Replaceable Seat Rings!*
When necessary, you can replace the seat rings easily . . . fast. Seat rings have wear-resisting and non-galling properties . . . made extra hard for years more service.

5. *Full Pressure Repacking!*
No need for costly interruption of flow to repack.

But check this lower maintenance cost for yourself. Next time you buy specify List 960 in sizes from ⅛" to 2". Rising stem with yoke (as illustrated) or rising stem inside screw type. For pressure range 2000 lbs. at 100 deg. F., 380 lbs. at 1000 deg. F. Specify List 990 for higher pressures.

The CHAPMAN Valve Manufacturing Company

INDIAN ORCHARD • MASSACHUSETTS

How About the Next Step?

This message is not for chief engineers, it's for their assistants—you younger men who are striking for chief. Next time you start thinking about your future, ask yourself these questions about your chief—the man whose job you hope to get when he retires.

1. Is he progressive? Does he believe in labor-saving equipment like automatic controls and coal- and ash-handling apparatus? And does he practice preventive maintenance to avoid trouble? Really encourage safety by insisting on thorough training, and by building platforms and catwalks so the men don't break their necks, and by providing protective clothing for hazardous jobs?

If the answer is NO, you're going to have a heck of a time selling these practices to management when you take over.

2. Does the chief keep on with his own education? Does he keep a good library of engineering books and technical magazines on hand and freely consult them to improve his know-how? Does he take time off every so often to attend engineering conventions to discuss his problems with other engineers?

No? Well, try reading on the job when you are chief, and management may think you're loafing. And try to get time off for engineering conventions. . .! This is something else you'll have to sell to management and it's not always easy to sell.

3. Does he assume his full responsibility and really run the plant? Or does the front office do it? Does he personally specify what make equipment goes into the plant, what supplies? Or does he just take what the front office gives him even though he knows something else will do the job better?

If he's content to have someone in the front office do the important parts of the chief engineer's job, you as the new chief will have to do some mighty tricky treading on toes to get the responsibility back where it belongs.

I guess you younger men get the point. Your chief right now is setting the pattern for your future job. Everything he *doesn't* do now you're going to have a hard time doing later.

What can you do about it? You can't hit the chief over the head with a slice bar. But with a well-chosen word here and there, you can get him thinking about improvements. Sort of get him to break the ice for you.

(And Chief, if you're still reading, maybe you get the idea, too. It's never too late to make with the stuff that gets raises.)

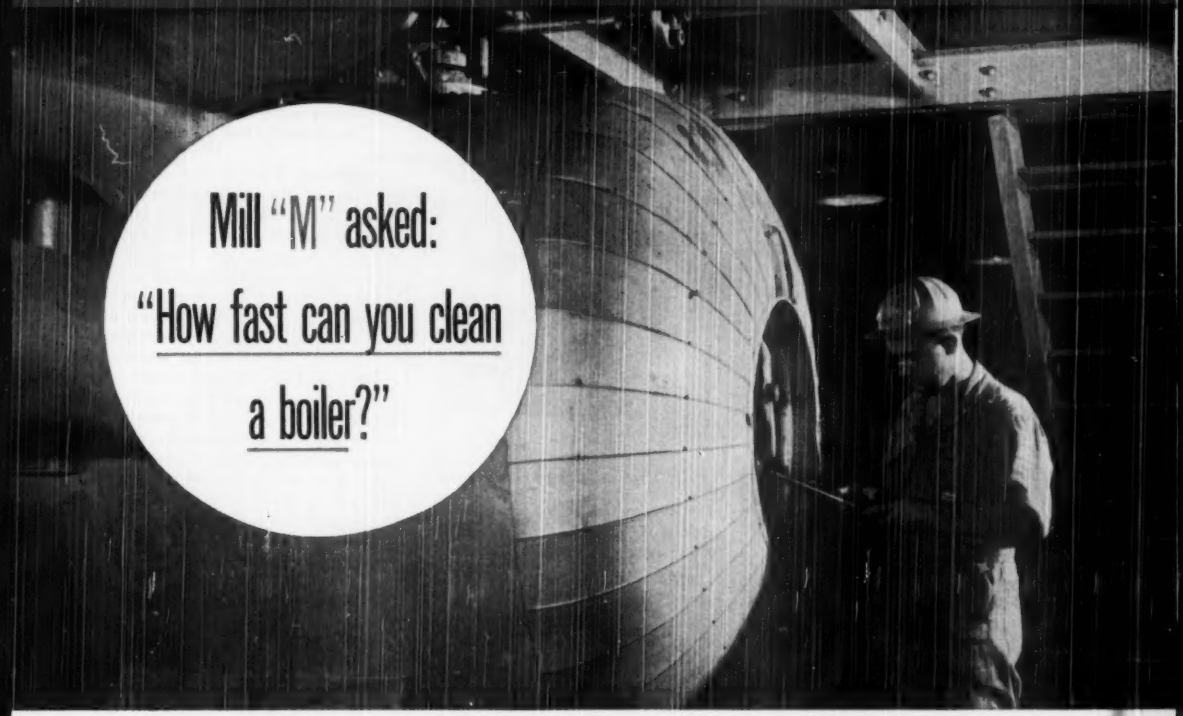
A final word to you younger men. If you're lucky enough to have a chief that's everything he ought to be, you're still going to have a hard time—trying to live up to him.

George Edwards

Engineer

DOWELL SERVICE

CHEMISTRY APPLIED TO MAINTENANCE CLEANING PROBLEMS



Dowell Service cleaned the internal surfaces in 10 hours!

This was the case of a boiler generating 350,000 pounds of steam per hour with an operating pressure of 1250 p.s.i. In ten hours Dowell Service removed an estimated 1,000 lbs. of deposits which were causing tube failures. The boiler was back on the line the next day.

What is Dowell Service? It is simply the application of chemistry to the problem of removing deposits from heat exchangers, water lines and all kinds of process equipment. Dowell engineers fill the equipment with liquid solvents which reach wherever steam and water flow and are designed to dissolve and disintegrate the deposits efficiently and quickly. Dismantling is not necessary.

Somewhere in your plant there is a job that can be done *faster, better, more economically* by Dowell Service. Let an experienced Dowell Service Engineer help you with your maintenance planning. No obligation, of course.

Other recent Dowell jobs:

Entire Piping Systems of two college dormitories cleaned of scale.

•

Three Formaldehyde Contact Towers and Reboilers cleaned and restored to designed operating efficiency.

•

Six Black Liquor Evaporators cleaned for paper company. Deposits removed from vapor and liquor sides in one operation.

CALL

DOWELL INCORPORATED · TULSA 3, OKLAHOMA

SUBSIDIARY OF THE DOW CHEMICAL COMPANY

New York 20	Buffalo 2	Kansas City 8	Mt. Pleasant, Mich.
Boston 16	Cleveland 13	Wichita 2	Hamilton, Ohio
Philadelphia 2	Pittsburgh 19	Oklahoma City 2	Charleston 27, W. Va.
Baltimore 18	Detroit 2	Houston 2	Salem, Illinois
Wilmington 99	Chicago 2	New Orleans 12	Borger, Texas
Richmond 19	St. Louis 8	Ft. Worth 2	Midland, Texas
Jacksonville	Indianapolis	Shreveport 69	Wichita Falls, Texas
Atlanta	Louisville	Anniston, Alabama	Lafayette, La.

Long Beach, Oakland, Casper: Dowell Associate—International Cementers, Inc.

DOWELL

A SERVICE ORGANIZATION

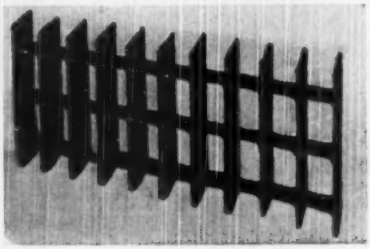
Under Extreme Conditions

of atmospheric corrosion

for Twelve Years

Here's a section from a panel of Hendrick Mitco that for twelve years was exposed to atmospheric corrosion in an open yard of an industrial plant. It was actually under water much of the time.

Note that the joints show the least corrosion and have no crevices or cracks, although the side surfaces of the bars have been partially eaten away.



90% is open area

Pressure-formed under hundreds of tons of hydraulic pressure, Hendrick Mitco Open Steel Flooring has rectangular openings with 90% open area which offers minimum obstruction to the passage of light and air. The uniformly spaced, square-edge bars provide a level, non-slipping walking and trucking surface.

Widths up to 38"; lengths to suit span. Standard Type C Flooring has bearing bars either 3/16" or 1/8" thick, spaced on 1 3/16" centers; transverse bars are spaced on 4" centers. Closer or wider spacings can be furnished to meet special requirements.

Plus a special safety feature

Shur-Site Treads for stairs, ladders and fire escapes are integral units of Hendrick Mitco Open Steel Flooring and have all Mitco advantages. For accident prevention, a heavy flanged nosing bar under the front edge of each tread makes the edge clearly visible; it also provides additional strength where the load is greatest.

Never require rebuilding

For floors, platforms, ramps and driveways, Hendrick Mitco Armorgrids withstand heavy loading and the hardest traffic. No structure armored by Hendrick Armorgrids has ever required rebuilding. The panels may be used with fill of concrete, cement, asphalt, or composition material, with the tops of the panels flush with the surface. Armorgrids are easy to install, because they are shipped completely fabricated and require no assembly work in the field.

Write for Hendrick Mitco Products Catalogue

SEE OUR CATALOG IN SWEET'S

HENDRICK

Manufacturing Company

46 DUNDAFF STREET, CARBONDALE, PENNA.

Sales Offices In Principal Cities

Perforated Metals
Perforated Metal Screens
Architectural Grilles
Mitco Open Steel Flooring,
"Shur-Site" Treads and
Armorgrids

Boiler Washing

(*Continued from page* 115)

4. Furnace draft, induced-draft fan suction and draft at an air heater (above and below).
5. Temporary connections for steam temperature into attemperator and out of superheater and temporary drum-metal temperatures.

Inspection. After boiling out, an inspection of the boiler showed: (1) There was a small amount of soft, black iron oxide at left and right ends of the drum. (2) Ten headers were clean and five contained a small amount of black iron oxide. Drum and all headers were then washed down and cleaned. There was no visible evidence of oil or grease upon final inspection.

Starting Up. As a preliminary procedure for starting up No. 1 boiler and Unit 2, 100,000-gal distilled-water tanks were filled with softened water, and the boiler was filled with softened water.

No. 1 boiler was started up Dec 10, 1948 with a rating of 70,000 lb per hr. Intermittent blowdowns were made from the drum each day. No. 1 main unit, a Westinghouse high-pressure machine, rated at 65,000 kw normal and 81,250 kw full load at 1250 psi, 925 F and 1.5 in. Hg absolute, was placed in service Dec 11, 1949. After the boiler and turbine-generator were in operation the following procedure was used to change over the makeup system from softened to distilled water.

1. No. 2 distilled-water tank, which was filled with softened water, was drained.

2. Softened-water makeup for No. 1 boiler was taken from No. 1 distilled-water tank by a boiler-fill pump and regulated to maintain a high level in the deaerator.

3. By maintaining a high level in the deaerator, valve between the distilled-water tank and the condenser was kept closed, so water could not flow from tank to condenser; valve between distilled-water tank and condensate pump was open, thereby permitting the condensate from the hotwell to be pumped to No. 2 distilled-water tank. Required makeup was maintained by adding softened water from No. 1 distilled-water tank.

4. After No. 2 distilled-water tank was filled with condensate the remaining softened water was drained from No. 1 tank and the valve between the two tanks was opened and the level equalized.

Boiler as Evaporator. As no evaporators were available at this time, No. 1 boiler was in effect used as an evaporator. Though the initial plans were to keep the rating on the boiler low until the distilled-water tanks were filled with

full branch tees

½ INCH THROUGH 30 INCHES

TO MARK PROGRESS

ANOTHER IMPORTANT DEVELOPMENT in the LADISH LINE of

Controlled Quality **FITTINGS**

THE COMPLETE FITTINGS LINE
PRODUCED UNDER ONE ROOF...ONE RESPONSIBILITY

LADISH CO.

CUDAHY, WISCONSIN
MILWAUKEE SUBURB

DISTRICT OFFICES: New York • Buffalo • Pittsburgh • Philadelphia • Cleveland • Chicago
St. Paul • St. Louis • Atlanta • Houston • Los Angeles • Havana

To increase safety, ease of installation and welding accessibility . . . Ladish Welding Tees have Full Branch Outlets with identical center-to-end dimension of branch and run as is required for each size *through 30 inches.* Scientific metal distribution . . . pioneered by Ladish . . . adds extra protection by equalizing stress over the entire fitting and assuring maximum strength in every cross section.

Oil in steam condensate reduced to less than .25 p.p.m. with the new . . .

SPARKLER PROCESS

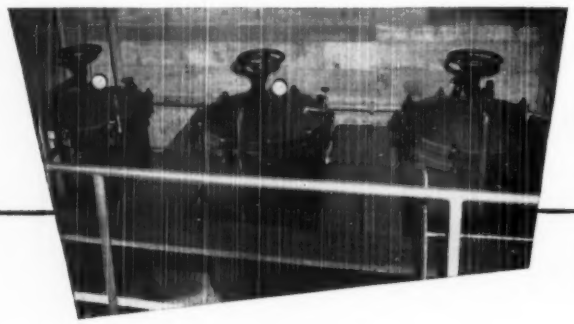
For the first time oil can now be easily and cheaply removed from return steam condensate down to the remarkably low point of .25 p.p.m.; under favorable conditions even as low as .1 p.p.m., and without loss of heat or water softening values.

The average skimming or trapping method of oil removal leaves 12 to 20 p.p.m. of emulsified oil in the water. The better oil adsorbent methods now widely used succeed in getting the residual oil down to 3 to 5 p.p.m.

The new Sparkler process, a much improved method based on the oil adsorbent principle, reduces the residual oil to the remarkably low point of .25 p.p.m. with capacity for any required flow rate, and without loss of heat or water softening values.

The engineering details of this new process will be very interesting to any power plant operator who is having difficulty with oil removal from return steam condensate.

Write Mr. K. L. Carr, Sparkler Mfg. Co., Mundelein, Ill. Give details of your problem. Our engineers will personally supervise the installation of this new process in your plant to insure efficient and satisfactory operation.



Filters used in one installation of this process that provide a flow rate of 200 gallons per minute.

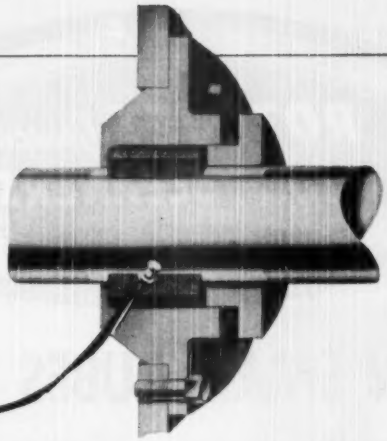
SPARKLER MANUFACTURING CO.

MUNDELEIN, ILL.

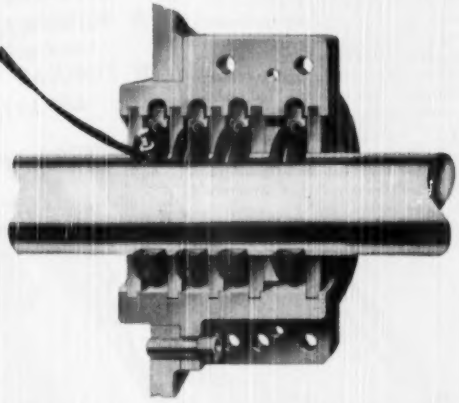
Makers of industrial horizontal plate filters for over a quarter of a century.

COPPUS TURBINES

offer you a choice of packing rings



STANDARD METALLIC RING PACKING — Made of high grade asbestos cores encased in specially treated lubricated aluminum foil. Recommended as a low-friction, long-service packing for steam temperatures up to 850 F and back pressures up to 50 lb. Adjustable packing glands keep leakage at minimum. Easy access to packing rings.



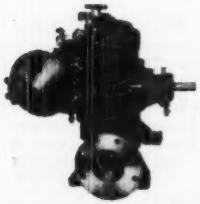
OPTIONAL CARBON RING PACKING — Consists of three carbon packing rings on the pressure side and one beyond the leak-off section. Each ring has three segments held together by a stainless steel garter spring. For back pressures up to 75 lb. Standard for vacuum or gas operation, or when leak-off is desired.

Heavy chrome plating on shaft at stuffing box is common to both types of Coppus packing.

Coppus Turbines ranging from 150 hp down to fractional in 6 frame sizes

FIT TURBINE COSTS TO HORSEPOWER NEEDS

When you buy turbines rated close to your exact horsepower needs, you save plenty of money. That's because turbines are generally priced in proportion to their size. The wide range of sizes of Coppus Turbines promises purchasing economy for you from the 150 hp size down to the smallest. As for operating and maintenance economies, you get them, too, from such other features as: greater number of manually operated valves for individual control of steam nozzles; replaceable cartridge-type bearing housings and others. For complete details . . .



WRITE FOR BULLETIN 135
COPPUS ENGINEERING CORPORATION
165 Park Avenue
Worcester 2, Mass.
Sales offices in
THOMAS' REGISTER

COPPUS "BLUE RIBBON" TURBINES

CLEAN SMALL TUBES FAST

With ROTOJET Junior Tube Cleaners you can clean tubes as small as .495" I.D. quickly and economically. Very little headroom is required for either vertical or horizontal tubes. Tube bundles can be cleaned without removal from shell.

The unusual power developed by the ROTOJET Motor is due to its simple design and exclusive Rotocentric (egg-shape) bore cylinder. A shaft and a blade are the only moving parts. Positive contact between blade and cylinder is always maintained. No leakage. No stalling at low speeds. Water-driven motors are also available.

Try ROTOJET Junior, and you will never go back to heavy, slow, external type cleaners costing many times more.

in
★ BOILERS
★ CONDENSERS
★ EVAPORATORS
★ SUPERHEATERS
and other
★ TUBULAR
APPARATUS

S32 ROTOJET Junior Air-driven Motor, universal joint, cone cutter.

C324 ROTOJET Junior Water-driven Motor, univ joint, pivot head

C439 ROTOJET Junior Air-driven Motor, universal joint, drill head.

C434 ROTOJET Junior Air-driven Motor, flexible coupling, expanding brush.

SEND FOR ROTOJET JUNIOR BULLETIN

ELLIOTT COMPANY-ROTO DIVISION
153 Sussex Avenue Newark 1, N. J.

condensate, need for power was so urgent that the boiler rating was increased to 100,000, then to 190,000 lb. At the end of three days it was up to 300,000 lb per hr. After nine days the boiler was at full rating, 500,000 lb per hr.

Condensate makeup was critical until Dec 21, 1948, when the first evaporator was placed in service. Quality of the delivered vapor was unknown as there were no gages, recorders, controls of any kind, or any means of collecting a sample available.

Table IV shows conductivity of water in the No. 2 distilled-water tank and the steam from No. 1 boiler for the first 30 operating days during the time the change from softened water to condensate makeup was made.

Table V analyzes a drum sample from No. 1 boiler for the first 30 days. Though no chemicals were added to the boiler for the first seven operating days, no detrimental effects were noted. Boiler concentration was gradually lowered by blowing down heavily.

Addition of chemicals to No. 1 boiler was made by dissolving potassium tetraphosphate, potassium hydroxide, potassium sulfite and potassium chloride in a 122-gal tank (24-hr supply) and pumping the solution through a Milton Roy 0-to-3-gph chemical feed pump at 1500-psi differential head. This discharges into the Hankison boiler-water recirculator discharge line, which enters the boiler feed line ahead of the economizer inlet.

Technical Briefs

(*Continued from page* 136)

firing instruments to measure fuel consumption, as fired, are probably economically unsound. But a little ingenuity can give fairly practical and close approximations.

Considerable improvement, especially in firing, can be made in small plants just by education. If you go to combustion controls, remember they will usually be maintained by inexperienced men. So make the control a simple one. *ASME paper; Metropolitan Section, Jr ASME.*

USE OF A MODEL TO STUDY STEAM SEPARATION IN BOILERS, *by Erich A Farber, University of Wisconsin.* Increase in output, pressure and temperature of modern boilers with smaller-sized units has brought into prominence the problem of steam separation—elimination of moisture and solid matter in steam leaving the boiler as well as recirculation of vapor through downcomers. Yet today boiler design is based mostly on experience and, to a lesser extent, performance data of similar units. So some way of predicting boiler performance

HIGHER TEMPERATURES • HIGHER PRESSURES

SIZE-FOR-SIZE, AT NO EXTRA COST

New FORGED STEEL VALVE

OIC SETS THE PACE IN VALVES

Here's the answer to your toughest pressure-temperature problems! It's the brand-new OIC Figure 1221, designed to take *higher* pressures, higher temperatures, tougher all-around operating conditions—with *no* increase in cost over its most popular competitors. It gives you a bonus of safety on your standard applications, and you needn't "step up" to more expensive valves to meet extra-high job ratings. You can *standardize* on the complete OIC forged steel line. You're in for a pleasant surprise when you check specifications of the new forged steel series, so don't wait. Call your nearest OIC distributor. *See this valve now!*

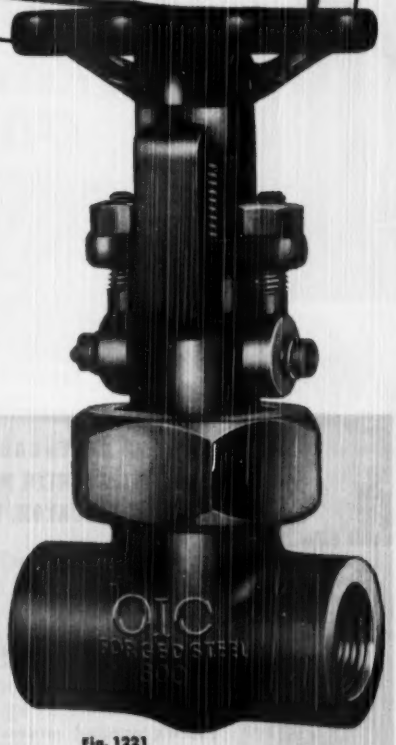


Fig. 1221

FIGURE 1221, shown right, comes in two standard trims—CH for oil or oil vapor at temperatures to 1000°F.;

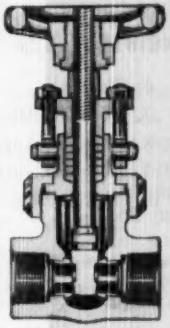
HCH for steam and other non-lubricating fluids to 850°F.

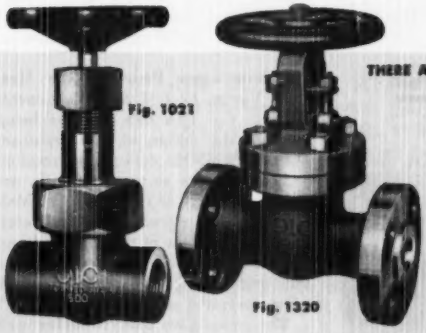
FORGED BODY, with wedge-guide machined in true relationship with bonnet joint for perfect alignment. Seat rings, of 13 Chrome stainless steel sealed tightly against body, keep out corrosive liquids, cut chemical action.

STEM, of 13 Chrome stainless steel, mates with a back-seating surface on bonnet, so valve can be repacked under full pressure. Wedge is a one-piece forging of 13 Chrome or hardened stainless steel, depending on trim.

OS&Y construction protects stem-threads from fluids and hot internal temperatures. Easy lubrication.

ALL METAL SECTIONS are extra-heavy to *exceed* recognized construction codes. Grain-pattern of forgings adds strength, provides safety, reduces wear.





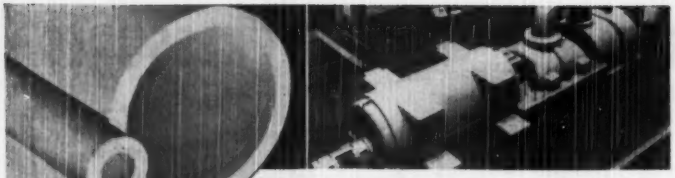
THERE ARE 262 DIFFERENT VALVES in the OIC forged steel line. It's the *longest* line ever presented to the trade at one time. Shown at left are two more gate valves—inside screw, Fig. 1021, and flanged end, bolted bonnet, Fig. 1320. But whether you need gates, globes, angles, or checks, be sure to investigate the *complete* OIC forged steel series. Write immediately for free descriptive material.

OIC

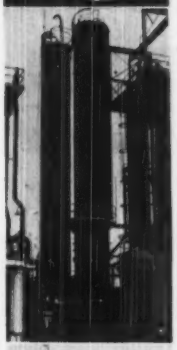
VALVES

FORGED STEEL • IRON
CAST STEEL • BRONZE

THE OHIO INJECTOR COMPANY
221 MAIN ST. WADSWORTH, OHIO

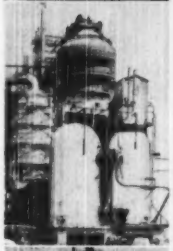


PROVED SUPERIOR IN EVERY FIELD!

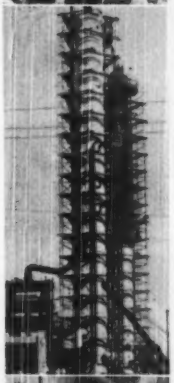


LIGHT-DENSITY TYPE PABCO PRECISION MOLDED 85% MAGNESIA INSULATION

Reg. U. S. Pat. Off.



THE DEPENDABLE STANDARD... MODERNIZED WITH MANY ADVANTAGES FOR APPLICATOR, ENGINEER, USER



1. Lighter Weight
2. Lower Thermal Conductivity
3. Controlled Uniformity
4. Attractive Smooth Finish
5. Greater "Ductile Strength"
6. Cleaner
7. More Durable
8. Easier To Apply
9. Precision Pipe Fit
10. Simplified Thickness Standards

Pabco's patented process revolutionizes the natural insulation superiorities of 85% Magnesia. Specify it for your projects.

Write nearest office below for your copy of our new, comprehensive catalog and engineering reference book on heat insulation.

THE PARAFFINE COMPANIES, INC.
INSULATION DIVISION
SAN FRANCISCO, 19 NEW YORK, 16

Manufacturers of Heat Insulation Since 1920

PABCO ENGINEERING SERVICE UNITS IN ALL PRINCIPAL CITIES

while still in the design stage would be very valuable.

To the author's knowledge only one other set of model tests have been run (R A Lorenzini, Foster Wheeler Corp). This set used water and air as media at atmospheric conditions.

First part of the author's tests were with the same media under the same conditions. His experience gave poor similarity beween test and actual boiler performance. Results were improved with an increase in pressure, up to 200 psi in steps. But when Freon-12 was used results proved the similarity was good. A particular pressure and temperature to which the model was raised corresponded to a certain boiler pressure and temperature. The model allowed varying: (1) load (2) pressure (3) liquid level—variables in a working boiler.

Purpose behind the tests was to find and compare the best design of baffles, separators, etc, normally called drum internals, to get the least carryover (moisture and solid content in steam leaving the boiler) and entrainment (vapor trapped and recirculated in downcomers of recirculating tubes).

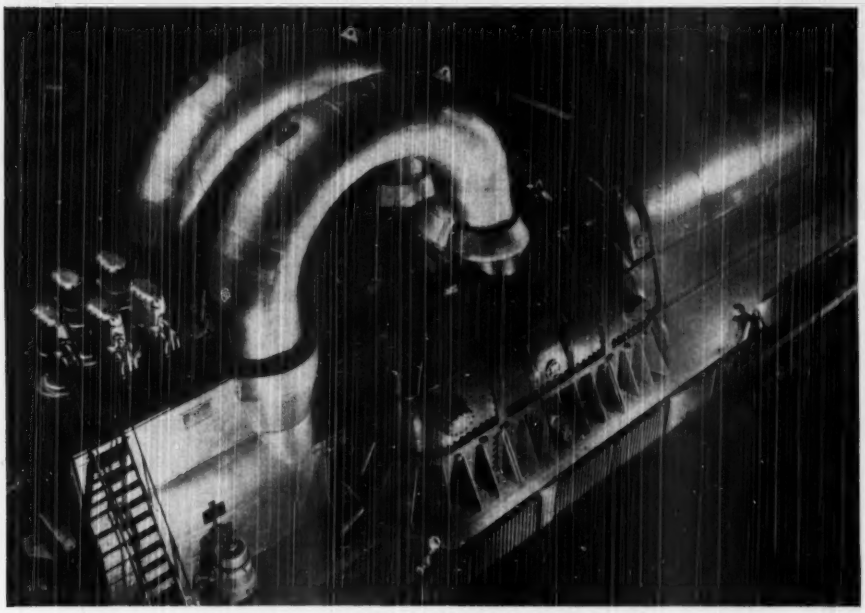
The model used had its drum constructed to about one third the size of a section of a Foster Wheeler boiler drum. This scale permitted standard pipes and tubes for risers and downcomers. A variable-speed motor drives the Freon-12 circulating pump so this quantity can be closely controlled. A compressor with check valves before and after allows throttling of vapor coming through the compressor or going through the drum. Both liquid and vapor circulate through the system and intermix in a mixing header, in any required weight or volumetric ratio.

A steam-heated coil in the mixing header brings the system up to any desired temperature which, in turn, sets the needed pressure. With Freon-12 the operating temperature was set at 145 F.

The author goes on to describe the experimental procedure, the different results, their evaluation, the effect of different media (air and water, Freon-12, etc) and closes with a summary of conclusions. *MWP paper; no number.*

THERMODYNAMIC PROPERTIES OF MERCURY VAPOR, *by L A Sheldon, General Electric Co.* This new table is being used in the design of mercury-steam stations. While the data contain residual errors, they are so small they do not affect the utility of the tables and Mollier diagram for practical work. Usefulness of the values in the saturated and moisture region have been justified by the performance of several mercury plants over the past 20 years.

The paper gives basic formulas used



Why Philadelphia Electric Company

PROTECTS ITS TURBINES *by CENTRIFUGAL FORCE*

This great power company uses De Laval centrifuges to purify the lubricating oil used in three different classes of turbines:

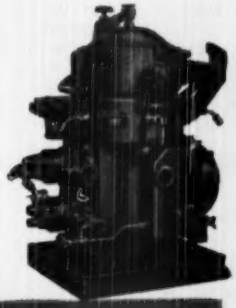
(1) Large turbines, with moderate steam pressure and temperature, and large volume of oil in the system

(2) Low pressure, low temperature turbine of moderate size with relatively small volume of oil in the system

(3) Topping turbine: high pressure, high temperature; larger quantity of lubricating oil

The De Laval machines remove the particles of dirt which may be picked up from the system ***and*** they remove any moisture that may be in the oil. Where inhibited oils are used, the centrifuge purifies the oil without removing the additives — an important advantage of centrifugal force.

In a word, De Laval centrifugal machines offer complete protection to all classes of turbines!



THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York 6 427 Randolph St., Chicago 6
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 5
THE DE LAVAL COMPANY, Limited, Peterborough, Ont.

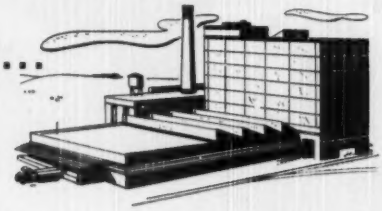
DE LAVAL
LUBRICATING OIL PURIFIERS

CORAVOL CASE HISTORY NO. 2

2nd in a series describing CORAVOL results in steam systems

Type of Operation...

DAIRY PRODUCTS MANUFACTURE



OPERATING CONDITIONS: Average evaporation 350,000 lbs. per 24 hours.

Make-up — 5%.

Operating pressure, 150 psi.

Steam used for milk processing, evaporating and drying.

PROBLEM: Corrosion in lines of steam system

CORAVOL STARTED: September 1944.

RESULTS: Complete protection of lines of steam system and no evidences of corrosion by steam or condensate.

USER COMMENTS: No objectionable features to use of CORAVOL in processing operations.

STOP STEAM SYSTEM CORROSION

with **CORAVOL** (the original* AMINE PROCESS)

CORAVOL in your steam system (1) prevents corrosion in lines, (2) cleans out clogging rust deposits. Thus, CORAVOL *protects lines;* improves heat transfer; restores original capacity of lines and efficiency of valves and traps.

CORAVOL is *not* a boiler feed water treatment—it is designed expressly for use in steam systems. Because **CORAVOL** volatilizes and condenses with the steam, it circulates throughout your entire steam system and protects *all* zones from corrosive attack.

CORAVOL IS PART OF A COMPLETE TECHNICAL SERVICE which provides special formulas of chemical treatment for: boiler feed water . . . hot water supply . . . refrigerating brine . . . cooling and condenser water . . . rapid scale removal . . . coagulation . . . algae control . . . fuel oil supply . . . soot removal.

*The use of CORAVOL in steam systems is covered by U. S. Patent No. 2053024. The Western Chemical Co., owner of this patent, grants licenses under which volatile AMINES purchased from other sources may be used in steam systems upon payment of royalty to Western Chemical Co.

WRITE TODAY for complete free data about the CORAVOL process.

WESTERN CHEMICAL COMPANY

713 Washington Street — Kansas City 6, Missouri

in calculating the tables and Mollier chart. One table has saturated properties listed against temperatures ranging from 225 to 1400 F. A second table has the same properties listed against pressures from 0.01 to 1100 psia. The properties are enthalpies of saturated liquid, vaporization and saturated vapor as well as corresponding entropies. The last columns list the specific volume of the saturated vapor. A Mollier chart covering an area 6x8 in. is included. *ASME paper No. 49-A-30.*

Electricity

POWER SUPPLY FOR MULTI-TRANSFORMER WELDING PRESSES, *by T F Ellis, Kaiser-Frazer Corp.* Because of a continuous demand for economical improvements in production methods, multiple-transformer welding presses have increased in resistance-welding applications. But the greatest benefits usually can't be had because it costs too much to provide an adequate power supply. The author has written his paper to furnish a guide for determining average resistance-welding characteristics.

In most installations, size and character of the instantaneous demand load are of primary importance. The required capacity of the supply system is determined by the effect of the load on other loads already served.

The nameplate on the welder transformer won't help estimate the kva load since usually it is a thermal rating and not a power one. The nature of the welding operation, and the design of the welder itself determine kva demand. Over and above these basic factors are the welding practices in the particular plant and the many variables associated with resistance welding.

The author presents a method used by one manufacturer to estimate the demand to series-weld SAE 1010-1020 mild steel in multiple transformer presses. The optimum welding current he shows has been found practical for actual experience. *AIEE paper; no number.*

MODERN-TYPE HIGH-POWER CIRCUIT BREAKERS, *by Robert H Nau, Electrical Engineering Dept, University of Illinois.* Pure description of the general operating principles of modern high-power oil-and-air-type circuit breakers.

Application of the impulse and multiflow principles is discussed in the section on oil circuit breakers. Treatment is basic throughout; ocb section is rounded out with a page on the parallel resistor and how it fits into the ocb picture.

Stepping into the air-breaker domain, the author outlines their best fields of application—high power where emphasis is on reduction of fire hazard

The Cincinnati Gas & Electric Co.

Stores ANYWHERE
Compacts FOR SAFETY
Reclaims ANYTIME

using Allis-Chalmers tractors

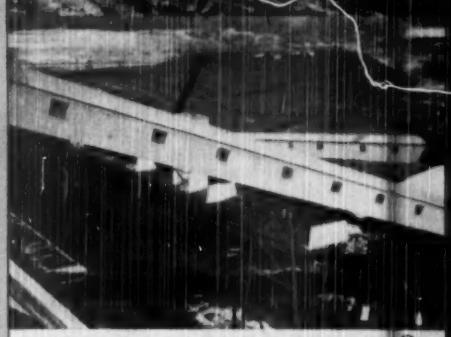
Handling coal with tractors permits placing storage piles wherever there is available space around the Miami Fort plant of The Cincinnati Gas & Electric Co. Additional storage areas can be put in service without installing conveyors, tracks, etc. — or abandoned without leaving money tied up in idle equipment.

Coal is easily stored to depths of 40 ft. or more . . . the tractor-scraper units further save space by spreading coal in thin layers and compacting it. Compacting also cuts down heat loss and danger of fire.

Reclaiming coal is just as simple and easy as storing it. The scrapers are self loading — efficiently haul from any pile to the reclaiming hopper as the coal is needed.

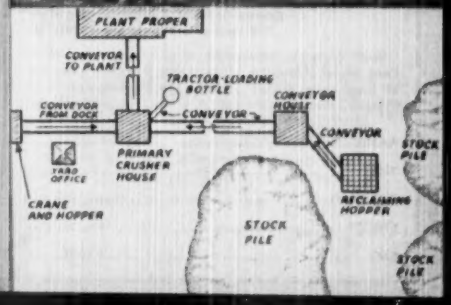
Bring greater economy and fire safety to your own coal handling with Allis-Chalmers Diesel Tractors. They can take care of all storing and reclaiming — or supplement existing equipment. See your Allis-Chalmers dealer or write direct for complete information.

Four Diesel-Powered Models—
11,000 to 40,000 lb.



The four Allis-Chalmers Diesel Tractors and Gar Wood scrapers on the job haul coal up to 1700 ft. for storing.

Reclaiming coal is simplified with the tractors and self-loading scrapers which dump into hopper. Tractors also are used with bulldozer blades for pushing coal to the hopper on short hauls.



Partial layout of The Cincinnati Gas & Electric Co. Miami Fort plant showing location of coal storage areas.

ALLIS-CHALMERS
TRACTOR DIVISION • MILWAUKEE 1, U. S. A.

Now..
with the
FEED

TYPE 149

Ample Power for Direct Action ...Easily Adapted to Remote Control

For Quick Solutions of Tough Problems, Count on *Climax!*

You'll be amazed at the ease with which a BS&B Controls Engineer can end your control worries. Strategically located, he is always ready to give you complete, understanding service... in strict confidence. Check the coupon below for the BS&B Controls Man nearest you.

You have a leverage ratio of 18 to 1 forming the connection between float and inner valve plug in the valve body of the BS&B-Climax 149 Feed Water Regulator. This means ample power to operate against differentials across the valve as usually encountered. Designed to serve as Feed Water Regulator or as Liquid Level Control. Combines the economy with the proved efficiency of Climax top-and-bottom-guided, reversible valve bodies.

Employ the type 149 float cage for direct control of level, remote of valves or instruments through air pilots, and operation of alarm systems or signals through Mercoid switches. Yes, sir... you can't beat this BS&B-Climax Control for versatility!

BLACK, SIVALLS & BRYSON, INC.
Climax Controls Division, Section C1-6-5
720 Delaware Kansas City, Mo.

Send complete information on following items, as checked: ☐ Type 149 Feed Water Regulator ☐ Type 320 Pressure Reducing Regulator ☐ Type 86 Diaphragm Valves ☐ Type 850 Displacement Liquid Level Controllers ☐ Have Sales Engineer call. Also send name of nearest BS&B Controls Man.

NAME_____

TITLE_____

COMPANY_____

STREET_____

CITY_____ STATE_____

Models available... in high tensile cast iron for pressures up to 250 psi, cast steel for up to 500 psi.

Complete description, diagrams, specifications and applications are ready for you. Mail the coupon... today!

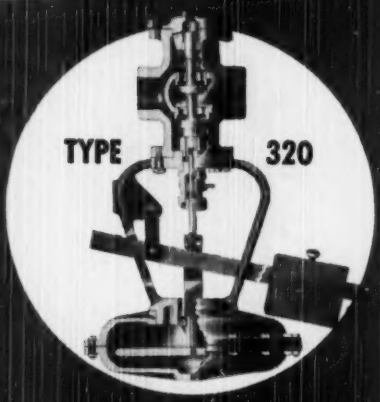
Climax Controls Division
BLACK, SIVALLS & BRYSON, INC.
KANSAS CITY • OKLAHOMA CITY • TULSA

Efficiency at a Real Saving

New BS&B Climax WATER REGULATOR

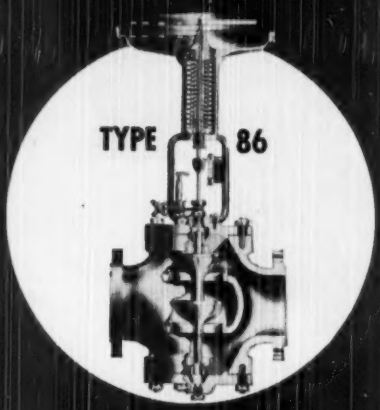
PRESSURE REDUCTION OR BACK PRESSURE REGULATOR

Type 320 Regulators allow sensitive pressure control in vapor-vacuum and low pressure steam heating systems. Weight loaded, pressure operated, diaphragm actuated. Built for long life under rugged conditions.



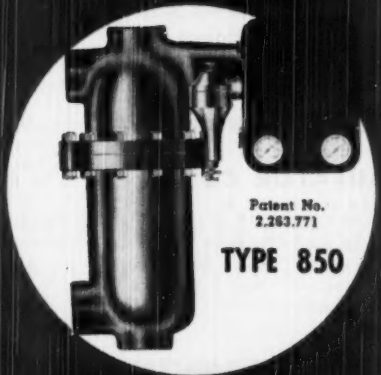
DIAPHRAGM CONTROL VALVE

Type 86 famous the world over for high lift, accurate control, ease of maintenance. Fully reversible in the field. Super-polished lower stem for minimum friction. Wide rangeability. Check coupon for catalog.



DISPLACEMENT LIQUID LEVEL CONTROLLERS

No leakage . . . no stuffing box . . . no friction problem! That's the Type 850, a BS&B-Climax-developed exclusive. Ideal wherever liquid level control involves exacting and wide range control. Shown here with Type 1410 BS&B-Climax Control Pilot. Complete catalog available . . . send coupon now.



and breaker maintenance. Operating principle of the magnetic air circuit breaker is covered along with the crossed-blast, compressed air-breaker and axial-blast, compressed-air job. In the magnetic air breakers, the short-circuit current is shunted through a multi-turn coil. This, in turn, produces a strong magnetic field perpendicular to the arc-stream in the interrupter. It's this magnetic pull that leads to quenching of the arc. A similar descriptive pattern is followed with the cross-blast and axial-blast breakers.

Trend to the future is painted by the author with a tie-in between our needs in the United States and those of Europe. A promising future is predicted for both air and oil breakers. *MWP paper; no number.*

Safety

INDUSTRIAL SAFETY IS GOOD BUSINESS, *by W B Barton, Chamber of Commerce of U.S.* For a decade the death rate from industrial accidents averaged about 16,000 each year. This decade includes the war years when possibly safety regulations were relaxed, workers less alert. Because of the waste in both human lives and economic potential the President of the United States called a Conference on Industrial Safety.

A staff was assembled, technical committees organized to study the factors involved. Employers and labor leaders alike cooperated with the Dept of Labor to develop details for the conference.

Investigations highlighted the fact that death and accident rate is low in most large industrial organizations. Why? For years these organizations have realized the need for safety and the cost of neglecting it. There is room, though, for the State to take an active part in leading all industry to a close study of the problem. One way, the author feels, is to set up an adequate basic safety law defining the duties of employers and employes.

A workable safety program should be based on accident reporting that will yield data for judging program-effectiveness. Similarly, data that permit reliable determination of safety costs to all concerned are a necessary tool. *Minnesota Governor's Conference on Industrial Safety, St. Paul, Minn. Feb* 9, 1950.

Heat-Pump

EARTH-HEAT PUMP RESEARCH, *by E B Penrod, University of Kentucky.* A package heat pump, donated to the University of Kentucky along with a financial grant-in-aid by the Kentucky Utilities, made possible a research program by the Engineering Experiment Station. The unit as received has two major

You'll See the Money You Save

WITH

MASONEILAN

500 SERIES

REGULATORS

You can count on Masoneilan "500 Series" reducing valves and pump pressure regulators for accurate control of steam pressures. Their proved-performance records in scores of industrial applications assure savings for you, too. Calibrated springs and ball bearing stem guides insure accurate responsive control. Available in sizes from ½" to 6"; maximum working pressures from 125 lbs. at 350°F., to 250 lbs. at 450°F.; pressure ranges ¾-3; 2-8; 6-25; 20-75; 60-160 lbs. Write for information.

MASON-NEILAN REGULATOR CO.

1186 ADAMS STREET, BOSTON 24, MASS., U. S. A.

Sales Offices or Distributors in the Following Cities:

New York • Syracuse • Los Angeles
Pittsburgh • Tulsa • Cleveland
San Francisco • Chicago • El Paso

MASONEILAN

St. Louis • Philadelphia • Houston
Atlanta • Denver • Salt Lake City
Cincinnati • Boise • Albuquerque

Mason-Neilan Regulator Co., Ltd., Montreal and Toronto

compartments: One houses the fan, its driving motor, two air filters; the second holds the refrigerating plant.

To measure the quantity of heat delivered or the amount of cooling produced, a direct system was attached. Averaging bulb-type meters were connected into the ductwork at inlet and outlet of the heat pump.

An earth-heat exchanger or ground coil, 553 ft of 1-in. soft drawn copper tubing buried about 4.5 ft served as the heat source. Lead-in branches are 18 in. apart, thermally insulated one from another and from the surroundings for a distance of 22 ft from the heat pump. There are 8 thermocouples at the center of the tubing for determining temperature.

The soil was analyzed to determine its characteristics for classification. The analysis, physical test data, etc, were presented as part of the paper as well as a measurement of its thermal diffusiveness.

Both heating and cooling tests, each of short duration, are reported. Conclusions are drawn up and discussed. *MWP paper, no number.*

SOME BASIC STUDIES IN PROPORTIONAL CONTROL, *by C E Mason, technical director, Bristol Co, and V Paschkis, technical director, heat and mass flow analyzer laboratory, Columbia University.* Studies carried out under supervision of Special Research Committee on Automatic Regulator Theory of ASME, with abstract of a more complete report submitted to the Research Division.

Purpose of the investigation was to examine the possibility of utilizing the heat and mass flow analyzer for accurate quantitative analysis of recovery transients in control problems. Two 4-capacitance continuous deadend circuits of different degree of control difficulty were selected.

Recovery transient of the more difficult one was calculated mathematically, based on comparison of the mathematical curve with that found on the analyzer. It is believed the latter can be used for an accurate quantitative analysis of control problems. *ASME paper No. 49-A-80.*

PLANT PROBLEMS

(*Continued from page* 132)

Oil withdrawn from the cylinder will be practically free of ammonia. There is no reason why a machine room should be filled with fumes whenever oil is withdrawn from the system. This also means that saving in ammonia may be considerable.

Oil is now placed in a container that is heated with a cartridge-type electr heater controlled by a thermostat at

Lubricating Compound

The Anchor Packing Company offers you a real "saver" in lubricating compounds . . . three distinct specifications: No. 5494 for hot water, steam, air . . . No. 5495 for cold water . . . and No. 5496 for volatile liquids.

Remember—the proper lubricant will assist greatly to obtain long packing life and prevent wear of moving parts.

We invite your inquiry today.

BRANCH OFFICES

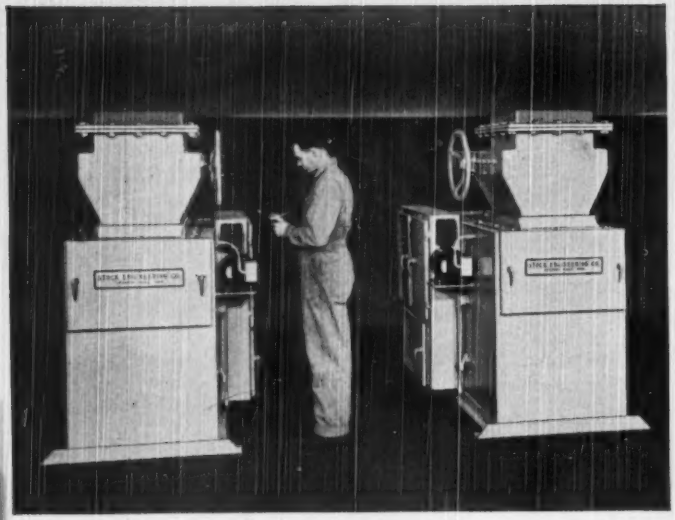
BALTIMORE, MD.
BOSTON, MASS.
BUFFALO, N. Y.
CINCINNATI, OHIO
CHICAGO, ILL.
CLEVELAND, OHIO
DAYTON, OHIO
DETROIT, MICH.
HOUSTON, TEX.
INDIANAPOLIS, IND.
LOS ANGELES, CAL.
MILWAUKEE, WIS.
MONTREAL, CANADA
NEW ORLEANS, LA.
NEW YORK, N. Y.
PHILADELPHIA, PA.
PITTSBURGH, PA.
SAN FRANCISCO, CAL.
SEATTLE, WASH.
SPOKANE, WASH.
ST. LOUIS, MO.
TOLEDO, OHIO
WILMINGTON, CAL.

THE ANCHOR PACKING COMPANY

GENERAL OFFICES: PHILADELPHIA, PA.

FACTORIES: MANHEIM, PA., ELKHART, IND., MONTREAL, CAN.

FIBROUS AND METALLIC PACKINGS FOR EVERY INDUSTRIAL PURPOSE



SMALL SPACE REQUIRED FOR

S-E-CO. COAL SCALES

S-E-Co. Coal Scales are designed with the idea of making them fit into the very minimum of space. For example, the overall height of the 200 pound scale, rated at 10 tons per hour, is 3'-9". The overall width and the overall length are also small.

If you are faced with the problem of fitting a coal scale into a plant arrangement that provides but little space for the coal scale, the S-E-Co. Scale is the machine for you.

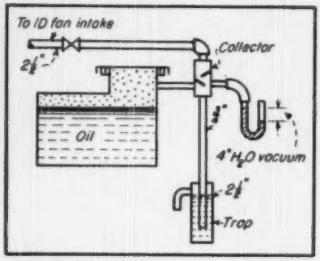
Write for dimension prints.

STOCK EQUIPMENT COMPANY
715P Hanna Building ★ Cleveland 15, Ohio

160 F. This oil is pumped through a filter containing fuller's earth and recirculated two hours. Oil thus cleaned shows little change in color. A plant that has the system described uses about 30 gallons of cylinder oil per year though about three gallons per day are fed and recovered. As pointed out, this oil is not used in the bearings.

Above may provide *WK* with a means for preventing most of the accumulation of water in the oil. It also shows a means for recovering all oil from the system without fumes and without waste of ammonia.

E H Roper *Toledo, Ohio*



This Rig Worked for Me

We were having considerable trouble with condensation in the oil tank of our 5000-kw turbine-generator. Sure, it's not the same as *WK's* case but our experience may help him. This amounted to about 1½ gal of water for 24-hr operation. Water had to be extracted daily. It was the cause of a certain amount of corrosion in the oil system.

To remove the water vapor, we installed a collector in the upper part of the tank, as in the sketch. Then we installed a 2½-in. pipe from intake of ID fan of our boiler, to the upper part of collector. So we maintain about 4-in. of water pressure in the collector. This effectively removes any vapor in the tank. Collector has two baffles, shown in sketch, to prevent small drops of water going into the 2½-in. pipe. We drain water from the collector by a small trap.

Manuel Cadrecha
Camaguey, Cuba

Try Electric Heating

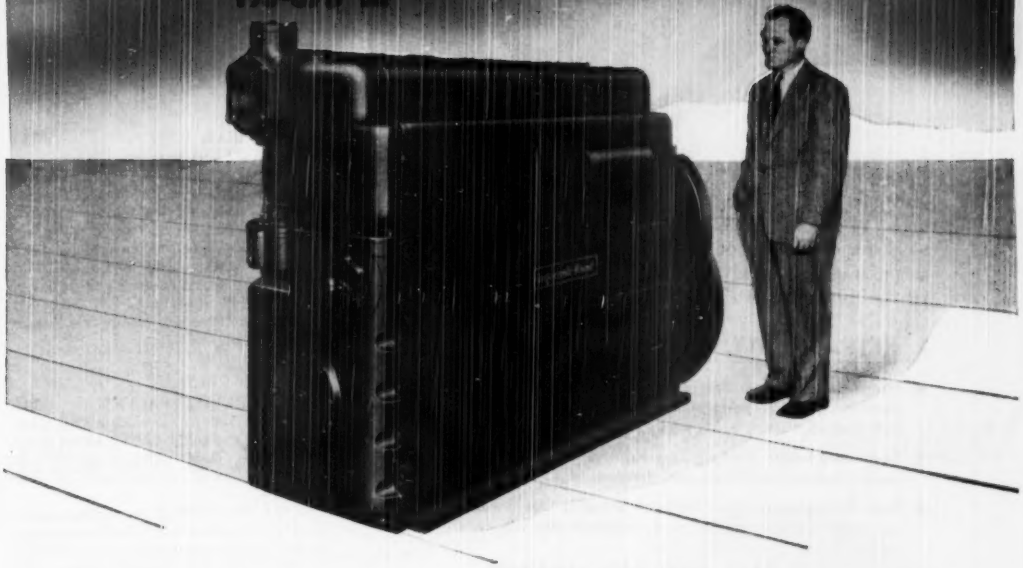
WK can cure his trouble by installing an electric heating element in each of his two mechanical lubricators. By maintaining oil temperature in lubricator well above boiling point of ammonia, say 150 F, all traces of ammonia will be removed from the oil. So no water will accumulate in lubricators. Temperature of 150 F does not destroy properties of the oil.

Henry R Carr *Buffalo, N. Y*

Now For The First Time

A SMALLER, LIGHTER, HEAVY-DUTY DIESEL ENGINE

The Ingersoll-Rand TS
195-375 HP



Here's the heavy-duty Diesel that engineers have been looking for... a 4-cycle, single-acting engine that weighs only 30 lbs per hp, and consumes only 0.40 lbs of fuel per hp-hour.

The Ingersoll-Rand TS Diesel is available with 6 or 8 in-line cylinders, delivering 195 to 375 continuous hp at 900 to 1000 rpm. What's more, the new TS Diesel has the extra stamina and dependability of big-engine design. Its 5¼"-diameter crankshaft is extra-large for a 7"-bore engine.

Movable	but NOT Automotive Type
Low Weight	but Moderate Speed
Small Size	but BIG-Engine Design
Powerful	but LOW Exhaust Temperatures
Perfect Balance	but NO Balancing Devices

These results have been achieved by using an improved combustion system with single-hole injection nozzles, a gear-driven supercharger providing additional scavenging air for internal cooling, an increased overlap of exhaust- and intake-valve openings, and a big crankshaft. One of the distinctive low-maintenance and long-life features is its aluminum-alloy full-floating bearings... with each half bearing being interchangeable for main and crankpin bearings.

Engineers who have seen the TS Diesel agree that it is the outstanding advance in diesel design in the past decade. Write today for more information on the new TS Diesel... or for greater power ask about the well-known S and SS Diesels up to 900 hp.

The New Ingersoll-Rand TS Diesel is ideal for:

Drilling Rigs	Locomotives	Emergency
Shovels	Drag Lines	Generating
Crushers	Cranes	& Pumping
Scrapers		Units

And for any service requiring continuous full-load economical operation.

Ingersoll-Rand

11 Broadway, New York 4, N. Y. 500-7

COMPRESSORS • AIR TOOLS • ROCK DRILLS • TURBO BLOWERS • CONDENSERS • CENTRIFUGAL PUMPS • OIL & GAS ENGINES

USE STRONG* STRAINERS -for *better* protection!

For steam, air, water and gas. STRONG'S new "Y" type strainer is ideal for the protection of steam traps, reducing valves, temperature controls, air control equipment, pumps, etc.

A HIGH-QUALITY, LOW-COST STRAINER!

★ **Monel Screen**—Mesh cloth in sizes ¼" to ⅜", larger sizes standard with .027 perforations. Self-centering guides prevent crushing.

★ **Semi-steel Body**—For rugged service. Sizes ¼" to 2". For steam pressures to 250 psi, cold pressures to 400 psi.

★ **Easy Installation**—New V-shaped gripping lugs on inlet and outlet bosses—may be easily installed with any type wrench.

CAST STEEL "Y" STRAINER

Available for pressures to 600 psi, screwed and flanged. Sizes ¼" to 4".

*Reg. Trade Mark

STRONG, CARLISLE & HAMMOND COMPANY

1392 West 3rd Street
Cleveland 13, Ohio

ANUM-METL Reg. Trade Mark

OTHER STRONG STEAM SPECIALTIES

No. 070 Small Trap | 80 Series Trap | "T" Type Strainer

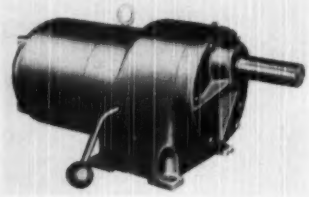
STRONG

NEW EQUIPMENT

(*Continued from page* 152)

Meter in mechanism is connected by drive shaft to generator through a coupling. Generator output is measured by a contact-making relay which, through its contacts and reversing relays, operates a motor that positions a control valve. Remote indicator measures generator output and indicates corresponding rate of liquid flow through the meter.

The Hays Corp, Michigan City, Ind.



MOTOR-GEAR UNIT **P555**

Type R3C features a combination electric motor and a 4-speed transmission having both primary- and secondary-gear reductions. Drive delivers full-rated in each of four speeds.

Units are designed for polyphase, ac, 25, 50, and 60 cycles below 600 v. All R3C units have primary selective gear ratios of 4.15, 3.15, 1.85 and 1 to 1.

The Lima Electric Motor Co, Dept AB59, Lima, Ohio.

SAFETY RELIEF VALVES **P541**

Complete line of cast-carbon and alloy-steel safety and relief valves is added to the bronze line. New constructions include all types formerly manufactured by Star Brass Co.

A typical valve, Fig. 73, is cast carbon steel with stainless-steel trim for pressures to 600 psi and temperatures to 650 F. Sizes are ¾ to 6 in. ASA standard flanged inlet and flanged or screwed outlet. NB certified and ASME tested. Valve is a Navy-approved adaption with high discharge capacity and close blow-down control, according to manufacturer. Other valves for air, steam, gases, vapors and liquids are available for a wide range of pressures and temperatures.

Kunkle Valve Co, 111 So. Clinton St, Fort Wayne 2, Ind.

VENT VALVE **P547**

Varec Fig. No. 5800 series vent valve has venturi inlet, hyperbolic pallets, center and side pallet, guiding and regrindable and renewable seats. Available without flame snuffer and in a wide range of pressure and vacuum settings. Flame-arrester part of the unit is listed by Underwriters' Laboratories for use on oil-storage tanks, approved by Associated Factories Mutuals' Laboratories for use on chemical storage, approved by U. S. Treasury Department for alcohol storage, and approved by U. S. Coast Guard for Marine Service. Device comes in a complete range of sizes from 2

Developed by three years of research . . . and now refined by tens of millions of dollars' worth of new equipment!

Gulf's GREAT NEW No-Nox

DESIGNED FOR TODAY'S POWERFUL NEW ENGINES!

Today's new cars have the most powerful *engines* ever made. AND—

They require a super, anti-knock gasoline.

Such a gasoline is the *new* No-Nox. It was especially designed by Gulf scientists—working hand-in-hand with leading automotive engineers—to give you *maximum* performance in your new car.

With a gasoline like this great new No-Nox, you can be *sure* your new car will perform at its brilliant best.

And the new No-Nox not only gives *new* cars peak performance. It also gives new life, new pep, and stops knocks in older cars too — even many with heavily carboned engines!

So no matter what model you drive, get a tankful of the *new* No-Nox today.

See for *yourself* what a difference it makes!

Whisper-Quiet, Knock-Free Power!
Easy, Fast-Firing Starts!
Quick, Safe Passing!
Unexcelled Mileage!

Terrific Power in Every Drop!

Good Gulf—our famous "regular" gasoline —is now better than ever, too!

Gulf Oil Corporation • Gulf Refining Company

NOTICE TO

Coal Users

IF you burn COAL, placing your name on our mailing list costs you NOTHING. The information made available to you can save THOUSANDS OF DOLLARS in future coal costs.

To be up-to-date on coal burning developments—more efficient plant design—greater flexibility in use of coal—modern standards of operating performance, etc. fill out the coupon below.

The Fairmont Coal Bureau through its technical bulletins and corps of fuel burning specialists offers consulting engineers and coal consumers a proven service on HOW TO CUT FUEL COSTS.

FAIRMONT COAL BUREAU
FAIRMONT REGION
WEST VIRGINIA
SERVICE TO INDUSTRY

MAIL COUPON TODAY!

FAIRMONT COAL BUREAU, Chanin Bldg., 122 E. 42nd St., New York 17, N. Y.

Kindly place me on your mailing list to receive copies of your publications and Technical Reference Bulletins.

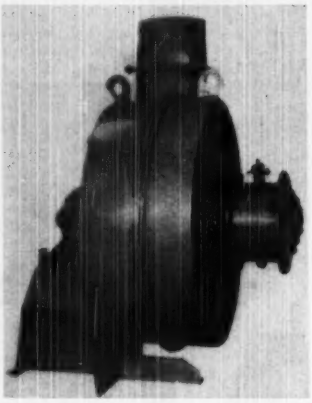
P-S-50

Name _____ Company _____

Position _____ Nature of Business _____

Address _____ City _____ Zone _____ State _____

to 12 in. and can be obtained in special materials to meet corrosion problems.
The Vapor Recovery Systems Co, Compton, Calif.



LARGE-VOLUME BLOWERS P565

Seven low-pressure large-volume blowers, direct-connected or V-belt-driven, have been added to the 300 Series. Units are vibration free, with fabricated steel-plate cases and bases, fabricated aluminum impellers.

Four-ounce blowers give 4000 and 4700 cfm with 7½- and 10-hp motors, respectively. Eight-ounce designs give 2480, 4250, 4800 cfm with 10- 15- and 20-hp motors. Two 3600-rpm blowers with 50- and 60-hp motors put out 6000 and 7500 cfm, respectively.
North American Mfg Co, 4455 E. 71st St, Cleveland 5, Ohio.

I-D BOILER FAN P569

Motor-driven, induced-draft fan, the *Bifurcator*, has a divided housing with the motor in an isolated asbestos-lined chamber, around which flue gas is by-passed.

Standard units range from 12 through 27 in. for boilers having from 200 to 1200 lb of steam per hour and operating temperatures up to 650 F.
De Bothezat Fans Div, American Machine & Metals, Inc, East Moline, Ill.

BATTERY CHARGER CONTROL P584

Double-duty charge-control unit is an accessory for automatically charging two batteries from a Hertner single-circuit battery charger. Both batteries can be placed on charge simultaneously at the end of a working shift and be fully recharged by time work is resumed in morning.
Hertner Electric Co, Cleveland 11, Ohio.

INSULATED SPLICE CAPS P583

Caps with insulators are available in larger size that accommodates five No. 14 or three No. 12 to two No. 16 wires. Splice cap is installed quickly and securely by means of crimping tool having four uniformly converging plungers which draw cap and inserted wires into solid permanent mass.

Cap is insulated quickly by pushing

For positive valve sealing

...THE UNCONDITIONAL K & M BELLOWS SEAL!

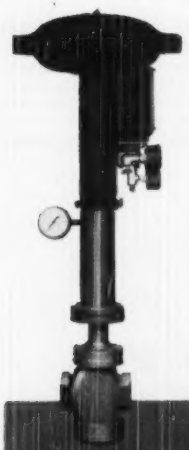
Designed by men who know automatic control valves, the K & M Bellows Seal is the ultimate in protection for valuable or toxic process fluids or in vacuum service where air infiltration would be serious.

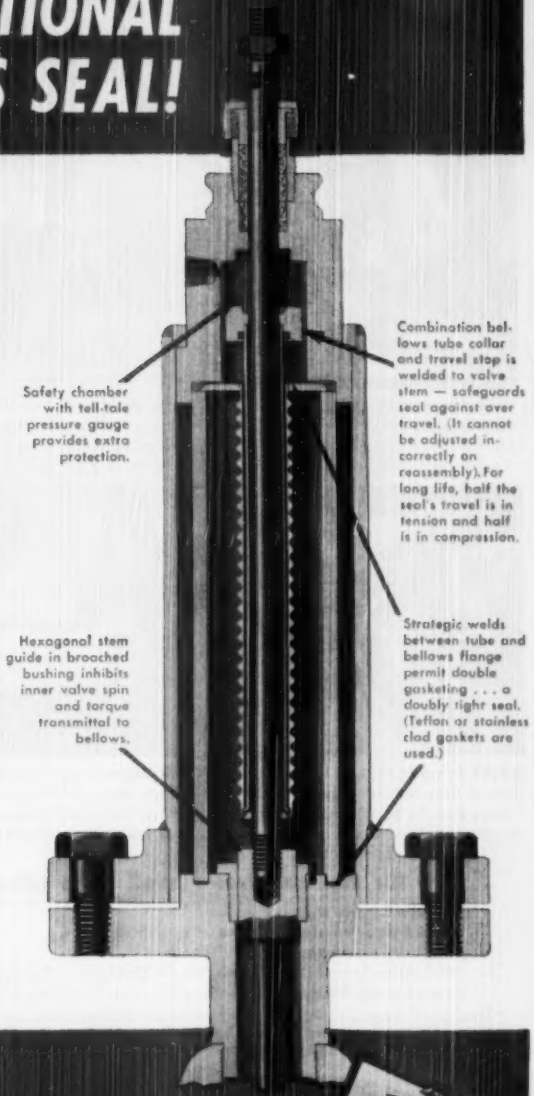
The seal is engineered to be unconditionally leakproof. Its efficiency is assured by its rugged simplicity . . . by ingenious functional extra safeguards inherent in the unique design of the seal itself.

Study the salient features as indicated on the cutaway view. Note also that the tube collar, the inner tube and the valve stem are positively sealed by welds — not threaded parts. The bellows, too, is sealed permanently at the bottom of the inner tube by a resistance weld; thus pressure is confined to the outside of the bellows where it can be more safely taken . . . furthermore, the bellows cannot buckle.

Here is the absolute seal between valve stem and valve body. Simple. Strong. Sure. Constructed of 3 ply Type 347 or 316 Stainless Steel, for pressures to 500 PSI and temperatures to 600° F. the K & M Bellows Seal is available with any K & M Diaphragm Motor Valve in sizes from ½ through 3 inches with full travel in each size.

Write for complete details.

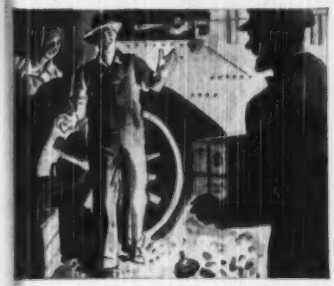



Safety chamber with tell-tale pressure gauge provides extra protection.
Combination bellows tube collar and travel stop is welded to valve stem — safeguards seal against over travel. (It cannot be adjusted incorrectly on reassembly). For long life, half the seal's travel is in tension and half is in compression.
Hexagonal stem guide in broached bushing inhibits inner valve spin and torque transmittal to bellows.
Strategic welds between tube and bellows flange permit double gasketing . . . a doubly tight seal. (Teflon or stainless clad gaskets are used.)

KONTROL DELAY & MOTOR

Contractor saves penalty of $500 — by investing $3.84 in Air Express

Time clause in housing project paving contract stood good chance of being invoked when equipment broke down at 5 P.M. So 10-lb. carton of replacement parts was Air Expressed from 1200 miles away. Delivered in just 8 hours. The Air Express charge was only $3.84—and contractor completed job on time.



$3.84 is small indeed, since it covers door-to-door service. Anytime delivery, 7 days a week. Makes the *world's fastest* shipping service the most convenient.

Air Express goes by Scheduled Airlines; extra dependability, *experienced* handling. Shipments keep moving. Regular use keeps *any* business moving.

Air Express gives you all these advantages

World's fastest shipping service.
Special door-to-door service at no extra cost.
One-carrier responsibility all the way.
1150 cities served direct by air; air-rail to 22,000 off-airline offices.
Experienced Air Express has handled over 25 million shipments.

Because of these advantages, regular use of Air Express pays. It's your best air shipping buy. For fastest shipping action, phone Air Express Division, Railway Express Agency. (Many low commodity rates in effect. Investigate.)

AIR EXPRESS
GETS THERE FIRST

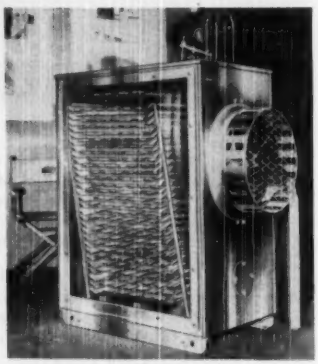
Rates include pick-up and delivery door to door in all principal towns and cities

A service of
Railway Express Agency and the
SCHEDULED AIRLINES of the U.S.

molded insulator over it and turning up red security ring to lock insulator firmly in place.

Device is approved by both Underwriters' Laboratories, Inc, and Canadian Standards Assn for circuits to 600 v.

Buchanan Electrical Products Corp, 1290 Central Ave, Hillside, N.J.



COOLING TOWERS **P533**

An addition of a 20-ton unit to the company's packaged *Aquatower* line of cooling towers will feature the new improvements carried by the rest of the line.

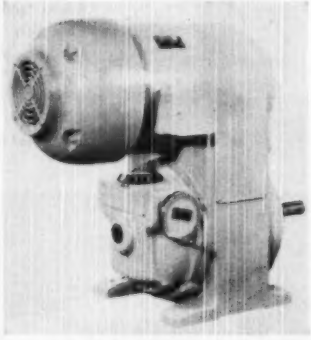
All tower interiors are rubber-lined. A new deep-pitch fan operates at about half the usual speed to give quiet operation.

Marley Co, Inc, Fairfax & Marley Rds, Kansas City 15, Kan.

COVER PLATE **P521**

Clear, methyl-methacrylate plastic coverplate can protect costly welding from welding spatter and other damage. Covers are 0.060 in. thick, and come in two sizes, 2x4½ in. and 2x4⅛ in.

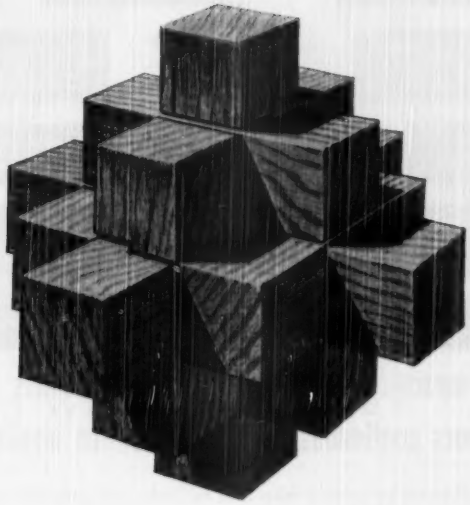
American Optical Co, Southbridge, Mass.



VARIABLE-SPEED MOTOR **P582**

Ample cooling of the *Speed-Trol* motor is accomplished by forced-draft ventilation with an external fan, protected by a streamlined fan cover. Unit is suitable for dusty or damp places, but is considered unsuitable for dripproof or open motors. It is

Water problems interlock



IN virtually every plant, all water problems are so complexly interwoven that no one of them can be solved without reference to the others.

Solutions of a sort may be relatively easy, but you want that specific group of inter-related procedures which — weighing results against investment, operating expense and maintenance cost — represent the most efficient and economic solution to the problems in *your* plant.

You get this from Hall Laboratories for Hall is equipped, through years of experience and *continuing* research, to deal with all types of industrial water problems — selection of sources, treatment of plant water supply, boiler water conditioning and other problems in power generation, industrial process waters, waste recovery and disposal.

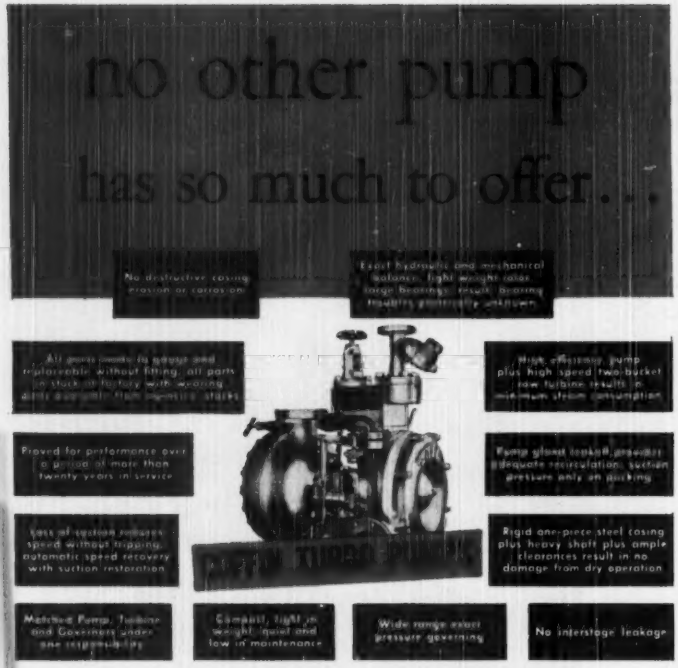
Hall *Plant-Wide* Water Service is your assurance that your water problems will be considered both individually and as a whole. May we send you a copy of our new bulletin "Let's Consider Your *Whole* Water Problem"?

Hall Laboratories, Inc., Hagan Building, Pittsburgh 30, Pa.

HALL *plant-wide* WATER SERVICE

BOILER WATER CONDITIONING

PROCUREMENT, TREATMENT, USAGE AND DISPOSAL OF INDUSTRIAL WATER


no other pump
has so much to offer . . .
No destructive erosion or corrosion
Exact hydraulic and mechanical balance, light weight rotor, large bearings, result bearing troubles practically unknown
All parts made to gauge and replaceable without fitting; all parts in stock at factory with wearing parts available from agents in stocks
High efficiency pump plus high speed two-bucket row turbine results in minimum steam consumption
Proved for performance over a period of more than twenty years in service
Pump glands leaktight, provided adequate recirculation, suction pressure only on packing
Rigid one-piece steel casing plus heavy shaft plus ample clearances result in no damage from dry operation
Matched Pump, Turbine and Governors under one responsibility
Compact, light in weight, quiet and low in maintenance
Wide range exact pressure governing
No interstage leakage

compact . . . noiseless . . . vibrationless

10,000 hours continuous operation between inspections!

LEADING engineers in industry today look for better and more efficient equipment to cut costs AND boost production efficiency. That's why Coffin Turbo Pumps are being specified on an increasing number of jobs — *they deliver more dependable performance than any other comparable pump on the market.* Backed by more than 20 years experience, Coffin Pump specifications have been proved time after time on hundreds of installations. Check these specifications in your files the next time you want *real* pump performance — steam pressures to 850 psi . back pressures to 200 psi . . pump capacities to 500 gpm . . . discharge pressures to 1100 psi . . heads to 2400 feet . . liquid temperatures to 300°F . . .

Complete description of Coffin Turbo Pumps are available on request or in the ASME Catalog or Sweet's File.

Specific proposals and application suggestions are available without obligation on receipt of operating data.

FREE!

A complete 4-page illustrated bulletin on COFFIN TURBO PUMPS with all operating data, applications, specifications that you may require for your next job. Write for Bulletin "S" today.

REPRESENTATIVES IN PRINCIPAL CITIES.

INDUSTRIAL • RAILROAD • MARINE PRODUCTS

COFFIN

162

The J. S. COFFIN, JR., COMPANY

326 SOUTH DEAN STREET, ENGLEWOOD, NEW JERSEY

used in such industries as rock and gravel plants, flour mills, grain elevators, sewage-disposal plants.

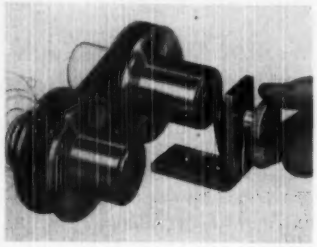
Motor features fingertip control of speed, allowing infinite speed adjustment through mechanical, electrical or lever-type controls. Motor is built integrally with pulleys, shafts and belts, in one compact unit for installation ease.

Sterling Electric Motors, Inc, Los Angeles, Calif.

AIR-VELOCITY METER P517

Model G Air-Meter provides instantaneous, direct, accurate readings of air velocities from 5 to 6000 fpm, and has a built-in temperature compensation to prevent momentary error when the probe is subjected to sudden temperature changes. Accessories are special probes and a carrying case with battery-operated power pack when 110 volts ac power is not available.

Hastings Instrument Co, Hampton, Va.



VARIABLE-SPEED SHEAVE P581

Five sizes of variable-speed combination sheaves cover a wide speed range and load capacities up to 7½ hp with speed changes as high as 7 to 1, between fixed-center shafts through use of standard V-belts. The new 3-, 4-, 5-, 6- and 7-in. single-groove sizes are available in spring-loaded and controllable types. This makes it possible to combine small driving sheaves with larger driven sizes for low-speed, or to use large driving sheaves with smaller driven sizes for high-speed ranges. Many combinations are possible, covering wide speed range and load capacities. The 8-in. size, built with double grooves, is designed for the larger horsepowers, and cannot be combined with smaller single-groove sizes.

The spring-loaded variable-pitch driving sheave is usually mounted on the motor shaft, and the controllable pitch one, of either the same or a different diameter, is put on the driven shaft. The control knob and bracket assembly furnished is secured to the machine base, and the standard V-belt snapped into place to complete the drive.

Speed Selector, Inc, 118 Noble Court, Cleveland 13, Ohio.

WATER-FLOW CONTROL P549

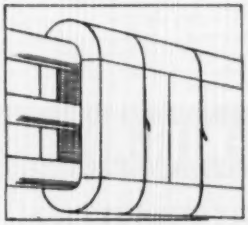
Flow interlock closes a contact when water flow exceeds a present amount and opens the contact when flow falls below the present amount. Device acts as a fuse in a circuit that depends upon water cooling for protection. Control can be adjusted for any flow from one to 4 gpm. Differ-

What's wrong with this picture?

This man is insulating these exposed water tubes the hard way. He's covering each tube separately, instead of insulating the group as a single unit. When boiler tubes, or any other group of hot lines, operate at the same temperatures and are as close together as these, it takes less time and less material to insulate them as one unit. This method is shown in the small illustration below. It also cuts down the area of exposed insulation surface, thus reducing the amount of heat lost by radiation.

Half sections of pipe covering are used on the outside lines, then all lines are boxed in together with insulating block. Of course, if the lines are spaced too far apart, or if they must be readily accessible for maintenance, each line should be insulated separately.

Sometimes whether to insulate piping singly or as a unit may be a pretty close decision. At other times, the answer may be obvious. But there is always one best way of doing this job, just as there is for every other phase of heat insulation work.



In cases like this, Armstrong engineers are trained to recommend the least expensive and most efficient methods. The complete contracting service they represent also supplies you with top-quality insulation materials and sundries, applied by skilled Armstrong installation crews.

If you consult an Armstrong engineer the next time you plan a heat insulation job, his advice may save you time and money. His services are always available without obligation. Call the Armstrong office nearest you or write to Armstrong Cork Company, 7005 Maple Ave., Lancaster, Pa.

ARMSTRONG'S INDUSTRIAL INSULATIONS

MATERIALS - INSTALLATION

FOR ALL TEMPERATURES FROM 300° F. BELOW ZERO TO 2800° F.

New "Packaged Unit" designed for aggregates, coal, coke, ores and other bulk materials

Equally applicable for both small or large scale operations, the new Hewitt-Robins Sectional Belt Conveyor is a packaged unit that can be assembled by your own workmen—and in considerably less time than required for conventional type conveyors.

From the variety of truss sections, head sections and A-frame supports you can select a conveyor system suited to your needs—in length, height, belt width and capacity. And, when you change locations, the conveyor can be disassembled, with sections added or dropped to suit conditions at the new site.

Like all Hewitt-Robins machinery, this new Sectional Belt Conveyor is carefully designed, strongly constructed. It is equipped with world-famous Robins Troughing and Return Idlers with one-shot lubrication. Curved decking protects the return strand of the belt.

And remember, only Hewitt-Robins is able to take single, unified responsibility for a successful Belt Conveyor installation —machinery and belting. For complete information on the new Hewitt-Robins Sectional Belt Conveyor, write today for Bulletin No. 132. Address Robins Conveyors Division, 270 Passaic Avenue, Passaic, N. J.

* * *

HEWITT-ROBINS SECTIONAL BELT CONVEYOR HEAD SECTIONS—3 types of drives to take motors from 2 hp to over 40 hp. Terminal pulleys (both head and tail) are solid welded steel with cast iron hubs.

TRUSS SECTIONS—2 designs—24" deep in lengths of 6'6", 15'6", 18'6", and 21'6"; 42" deep for greater spans. Side members all-welded construction; diagonal bracing members have jig-drilled holes for quick field assembly.

BENT SUPPORTS—A-frames are available in complete range from 4' to 50' deep—easily erected.

BELT WIDTHS—18", 24", 30" and 36". Lengths up to belt limitation.

HEWITT-ROBINS
BELT CONVEYORS

HEWITT-ROBINS HR **INCORPORATED**

BELT CONVEYORS (*belting and machinery*) • BELT AND BUCKET ELEVATORS • CAR SHAKEOUTS
DEWATERIZERS • FEEDERS • FOAM RUBBER PRODUCTS • FOUNDRY SHAKEOUTS
INDUSTRIAL HOSE • MINE CONVEYORS • MOLDED RUBBER GOODS
RUBBERLOKT ROTARY WIRE BRUSHES • SCREEN CLOTH • SKIP HOISTS • STACKERS
TRANSMISSION BELTING • VIBRATING CONVEYORS, FEEDERS AND SCREENS

ential between cut-in and cutout is 0.2 gal minimum and 0.4 gal maximum. Available complete with union fitting and strainer attachment. Electrical rating is 10 amp at 125 volts, 5 amp at 250 volts, and 3 amp at 460 volts, all ac. Maximum line pressure that interlock will withstand is 125 psi.

General Electric Co, Schenectady 5, N.Y.

MOBILE PLATFORM **P575**

Beanstalk is a one-man-operated working platform with a maximum height of 17 ft. Manual hydraulic pump gives full elevation in two minutes. Complete framework folds up so it can be carried through door 6½ ft high.

William Moss & Sons, Ltd, Mechanical Developments Div, N Circular Road, Cricklewood, London, NW 2, England

WELDER MASK **P566**

Air-tight rubber mask and chrome-leather hood, with flexible-tube connections, give protection against ultraviolet and infrared radiation, impact and pitting, and inhaling of toxic fumes.

Three lenses are used: (1) permanent, safety lens sealed in the assembly (2) removable welding lens and (3) removable

for Safety, Surety and Savings

...OPERATE DISTANT VALVES by LIMITORQUE REMOTE CONTROL

The important safety factor afforded by *LimiTorque Remote Control* cannot be overstressed, because men do *not* have to go to high, low, dangerous or inaccessible locations to open and close valves. Further, *LimiTorque* prevents damage to seats, discs, stems, etc., because it *"automatically" shuts-off the power,* should an obstruction in closing occur.

Think of the savings effected in time and money by eliminating men going from one valve to another (many of which are at distant locations)—not to mention the time required to shut or open each valve. *LimiTorque Remote Control* not only prevents this waste, but enables one man to merely *"push buttons"* and actually see on a panelboard whether the valves are open or closed.

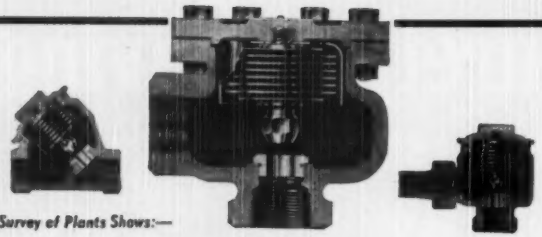
Various *LimiTorques* are available for different requirements on all types of valves (globe, gate, butterfly, plug, etc.)—and, too, *LimiTorques* may be supplied for actuation by any power source, such as electricity, steam, water, gas, oil or air.

Thousands of *LimiTorques* are in use throughout the world, on land and sea. Be convinced; send for our 96-page catalog, L-48, and please use your Business Letterhead when requesting it.

Philadelphia Gear Works, INC.

ERIE AVE. AND G ST., PHILADELPHIA 34, PA.
NEW YORK • PITTSBURGH • CHICAGO • HOUSTON
IN CANADA: WILLIAM AND J. G. GREEY LIMITED, TORONTO

Industrial Gears and Speed Reducers
LimiTorque Valve Controls



Survey of Plants Shows:—

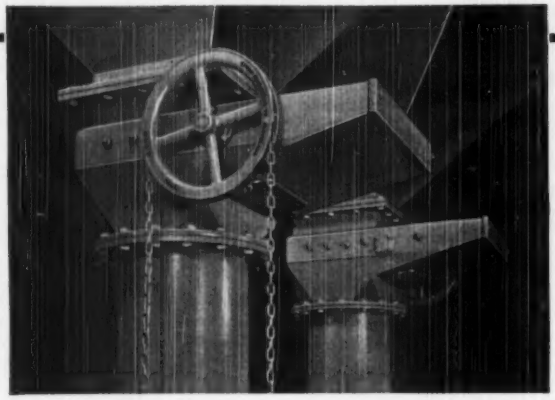
15 of 20 Engineers Prefer Nicholson Traps

To determine the best steam trap on which to standardize, a large processing firm recently asked their plant engineers for their preference. In 15 out of 20 plants the choice was Nicholson.

The repeated adoption of Nicholson steam traps in plants currently in big "cost-reduction-through-modernization" programs is another indication of their advanced features. To learn why an increasing number of leading plants are standardizing on Nicholson thermostatic steam traps send for our catalog. 5 types for every power, heat, process use; size ¼" to 2"; press. to 225 lbs.

Catalog 448 or see Sweet's

W. H. NICHOLSON & CO. 125 OREGON STREET WILKES-BARRE, PA.



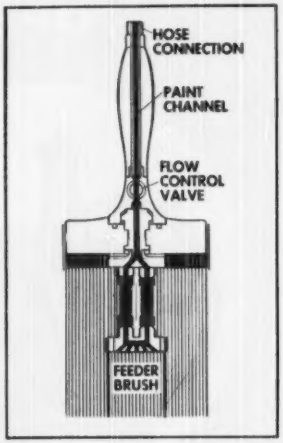
S-E-CO. COAL VALVES are available in many sizes and types. Sizes range from 6" to 30". Either round or square flanges are available. Top of valve may be flanged or equipped with studs. Handwheel or chain operation available.

Write for Bulletin

STOCK EQUIPMENT COMPANY
715P Hanna Building ★ Cleveland 15, Ohio

pitting lenses. Different shades of filtering lens can be used, depending on type of welding.

Mines Safety Appliances Co, 201 N. Braddock Ave, Pittsburgh, Pa.



PRESSURE-FED PAINT BRUSH **P532**

Four brushes called *Stream-Flo*—oval design, 2½ in., and flat design, 3, 3½ and 4 in.—have hose connected to handle that delivers paint under 20 to 30 psi to a feeder brush set within the main brush, see illustration.

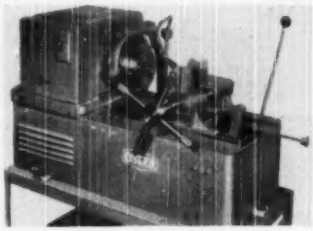
The feeder distributes paint evenly through the bristles of the main brush. A valve in the brush handle controls paint flow. Standard pressure equipment and fittings are used throughout. Paint can be mixed and placed in a pressure tank. Several brushes operate off this single tank.

Harlon & Goodman Co, Belleville, N.J.

BRONZE VALVE **P507**

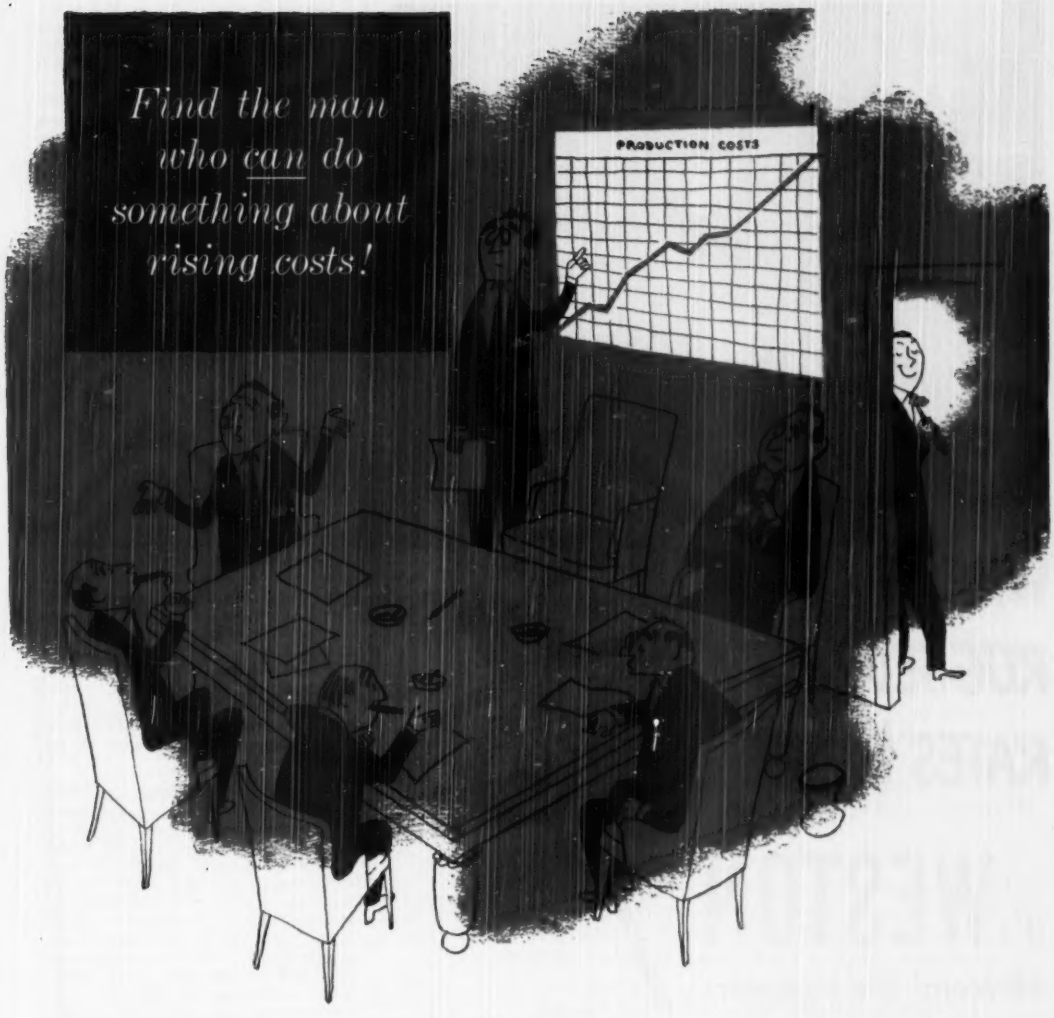
Hancock bronze valve with 500 brinnell stainless-steel seats and disks in sizes of ¼ through 2 in., and in globe angle types with screwed ends. Designed for pressure up to 150-psi saturated steam and non-shock cold water, oil or gas.

Manning, Maxwell and Moore, Inc, Watertown 72, Mass.



PORTABLE PIPE THREADER P537

Tom Thumb models, No. 532 and 582-R, thread pipe from ¼ to 2 in. standard range; extra range ⅛-in. pipe, extended range with drive shaft, 2½ to 8 in. Both models have



In most businesses, operating costs are still on the rise. But there's *one* man who *can* do something about it—he's the man whose job is to get maximum heat and power from fuel dollars. He knows you *get* maximum efficiency from Eagle-Picher Industrial Insulations because they're made of durable, chemically and physically stable *mineral wool*, noted for its low conductivity. They give long years of service and are easy to maintain and replace.

There's an Eagle-Picher insulation that can help reduce *your* operating expenses!

Let these Eagle-Picher products also save you money . . . power . . . time

Insulating Felts
Supertemp Block • Blankets
Loose Wool • Pipe Covering
Stalastic • Insulseal • Insulstic
Swetchek • Finishing Cements
Insulating Cements

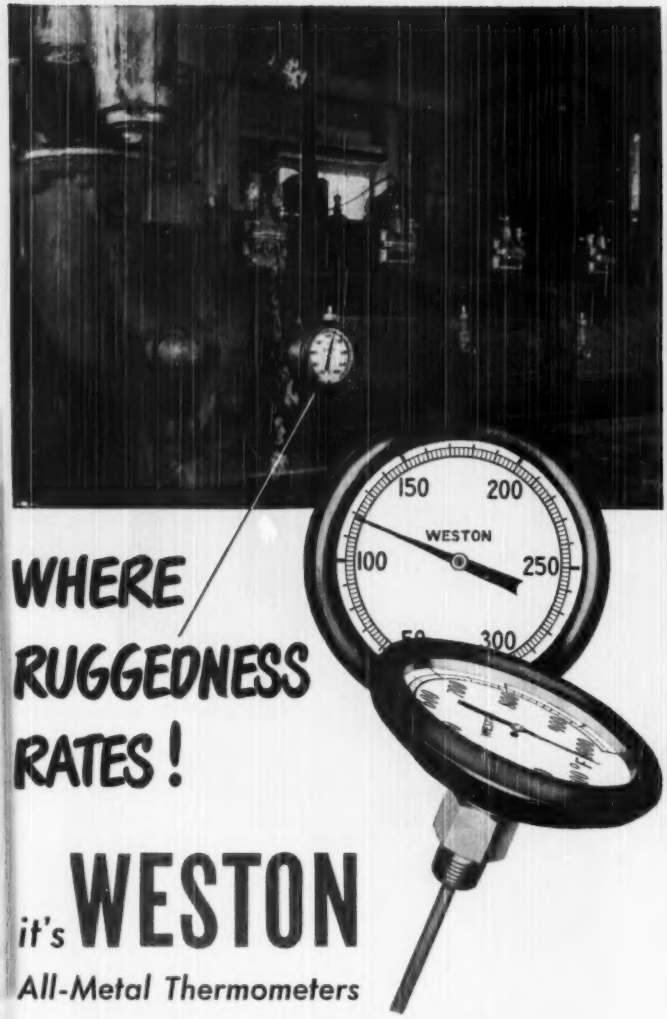
THE EAGLE-PICHER COMPANY

General Offices: Cincinnati (1), Ohio

Insulation products of efficient mineral wool—for a full range of high and low temperatures. Technical data on request.

EAGLE EP PICHER

Since 1843



WHERE RUGGEDNESS RATES!

it's WESTON

All-Metal Thermometers

Where the going is tough, WESTON thermometers get first call. Their rugged construction—all-metal throughout—enables them to stand up on pumps, compressors and mobile units. And the big, bold dials are easy to read—quickly and accurately! There are many types, stem lengths and scale ranges from which to choose. Ask your jobber or local WESTON representative, or write for Thermometer Bulletin. WESTON Electrical Instrument Corporation, 679 Frelinghuysen Avenue, Newark 5, New Jersey.

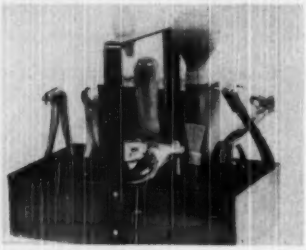
CONTACT-MAKING models for alarm or control purposes. MAX-MIN models to indicate highest or lowest temperature reached.

WESTON *Instruments*

a bolt range of ¼ to 1½ in. Models No. 581-A and 582-A are designed primarily for threading bolts from ¼ to 1½ in. No. 581-A has pipe range of ⅛ to 1¼ in. Pipe range of No. 582-A is ¼ to 2 in.

All four models have ½-hp 6-pole 7500-rpm universal motors. Machines have hardened and ground worms and bronze worm gears with V-belts drive through back gears. Spindle speed of No. 582 is 30 to 65 rpm, No. 582-R is 25 to 50 rpm, No. 581-A is 47 to 105, and No. 582-A is 30 to 65 rpm.

The Oster Mfg Co, Cleveland, Ohio.



BATTERY TOOLS **P579**

Battery service kit, GS No. 3F, consists of a steel tray with handle and compartments for holding battery-servicing tools and water. Water jar has two holes; one to hold hydrometer and the other for a battery filler.

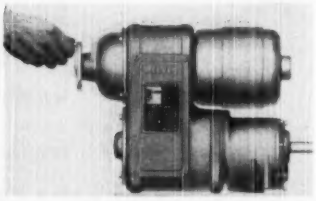
Other compartments are spaced to hold battery-terminal spreader, piler, carrier, brush and terminal puller.

General Scientific Equipment Co, 2700 W Huntington St, Philadelphia 32, Pa.

WET-WATER BLENDER **P576**

Hydroblender introduces wetting agents into a flowing stream of water to reduce its surface tension and give it greater wetting power and penetration. Device is cast brass with a Lucite tube, and weighs about 35 lb. Easily mounted on a wall, machine or building column. Chemicals are placed in the Lucite tube in the form of water-soluble capsules, which dissolve in proper proportion to water flow. Each capsule makes a minimum of 1000 gal of wet water with its surface tension reduced from 72 to 30 dynes. Hydroblender holds two capsules.

Aquadyne Corp, 220 East 42nd St., New York 17, N. Y.



VARIABLE-SPEED DEVICE **P578**

Small, compact motorized units in fractional-hp sizes are now available. Like the larger models, the small units combine motor, speed-varying mechanism and reduction gears in one package. Sizes are

stop coupling failures!

FIND OUT HOW *Koppers Engineers Eliminate Needless Downtime* IN YOUR PLANT!

These FAST'S COUPLING *Services save you money!*

UNSURPASSED ENGINEERING . . . Koppers engineers are acknowledged the best in the industry. Their practical knowledge, backed with 30 years' coupling experience, is at your service!

IMMEDIATE DELIVERY . . . All standard types and sizes are available for immediate delivery from "on hand" stocks. In case of emergency, just wire factory for special rush delivery!

LOWEST COST PER YEAR . . . Fast's Couplings will outlast equipment they connect if properly maintained. Their cost may be spread out over 25 years or more, offering you lowest coupling cost per year!

KOPPERS

FAST'S

THE ORIGINAL GEAR-TYPE

Couplings

Before your plant is harassed by needless coupling failures—*call on Koppers!* Only Koppers offers you a two barreled solution to coupling problems: Fast's Couplings, the original gear-type coupling—and Koppers Engineering Service, acknowledged the finest in the industry!

For *30 years,* Fast's Couplings have been industry's standard for *long life* at *low cost.* Now, in addition, when you specify Fast's you get the *extra* advantage of Koppers valuable Engineering Service. Koppers engineers, backed with 30 years of Fast's Coupling experience, study your problem. Then show *which* Fast's Coupling you need (and more important) *why you need it!*

Only Koppers can offer you both Fast's Couplings and unexcelled engineering service—so before you buy *any coupling,* get the complete story on Fast's. Full details are contained in the Fast's Catalog. For your free copy, send the coupon today!

Send for

FREE CATALOG

KOPPERS CO., INC., *Fast's Coupling Dept.,*
225 Scott St., Baltimore 3, Md.

Please send me a copy of Fast's Catalog relative to.....
.....(type of industry).

Name.....

Company.....

Address.....

City.....Zone.....State.....

The Time to Worry About

FIRE

Is BEFORE It Strikes!

● It's frequently said that, *when fire strikes*, the first 60 seconds are the most important. But, ability to capitalize those vital seconds is equally important. And such ability comes only from *advance* planning . . . and action!

Make the check now that reveals the danger spots in your operation. Match the cost of quick, adequate protection against the loss from a disastrous fire . . . or even a small fire in a key location. The time to worry about fire is *before* it strikes!

CARDOX—pioneers of low pressure carbon dioxide as an effective fire fighting medium—will welcome the opportunity to cooperate in this vital check-up. **"CARDOX" Low Pressure Carbon Dioxide Fire Extinguishing System*** provide many fire-fighting advantages.

Such skillfully engineered systems, in pounds or tons, provide amazingly quick, positive extinguishment.

**Covered by issued and pending patents.*
Write for Bulletin 345.

CARDOX *offers all* THREE

• EXTINGUISHMENT
Cardox engineered applications give carbon dioxide enhanced effectiveness for faster, surer extinguishment of large or small fires, indoors or out.

• PREVENTION
Cardox Atmosphere Inerting Systems provide low-cost inert gas for continuous fire and explosion protection

• DETECTION
Cardox Detection Systems, actuated by heat, smoke or flame, operate as a warning device or to actuate fire extinguishing systems.

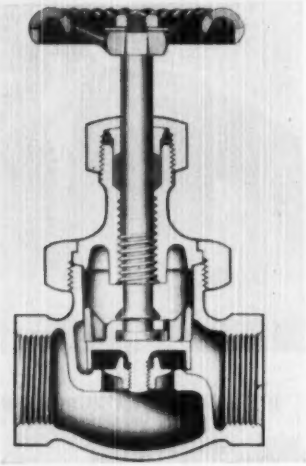
CARDOX

CO_2 FIRE EXTINGUISHING SYSTEMS

CARDOX CORPORATION • 307 NORTH MICHIGAN AVENUE • CHICAGO 1, ILLINOIS
DISTRICT OFFICES: New York • Philadelphia • Pittsburgh • Wheeling • Detroit • St. Louis
Los Angeles • San Diego • San Francisco

1/3, ½, and ¾ hp for stepless speed ratios of 10 to 1 for each size. Their compactness makes them well suited to applications where space is limited. A total of 24 different assembly combinations for vertical and horizontal floor or wall mounting can be had.

Reeves Pulley Co, Columbus, Ind.



LOW-PRESSURE VALVE P513

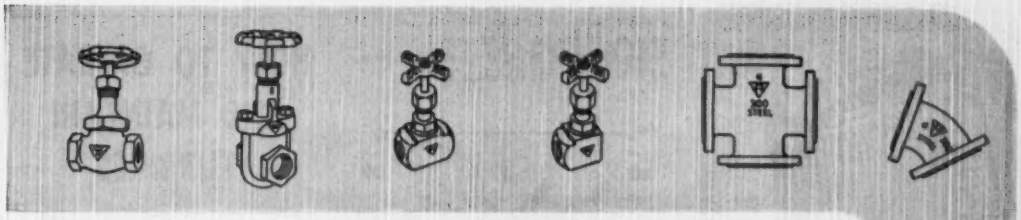
Gas valve of globe, angle and check design for liquefied petroleum gas service has been tested and approved by Underwriters' Laboratories, Inc, for use up to 250 psi maximum. All three types have screwed ends, in sizes from ¼ to 2 in., inclusive. Valves have a Crane No. 6 composition disk cemented into the disk holder. They are recommended for hot or cold water, compressed air, gasoline, light oils, and other services.

Crane Co, 836 S. Michigan Ave, Chicago 5, Ill.

SELF-PROPELLED PUMP P553

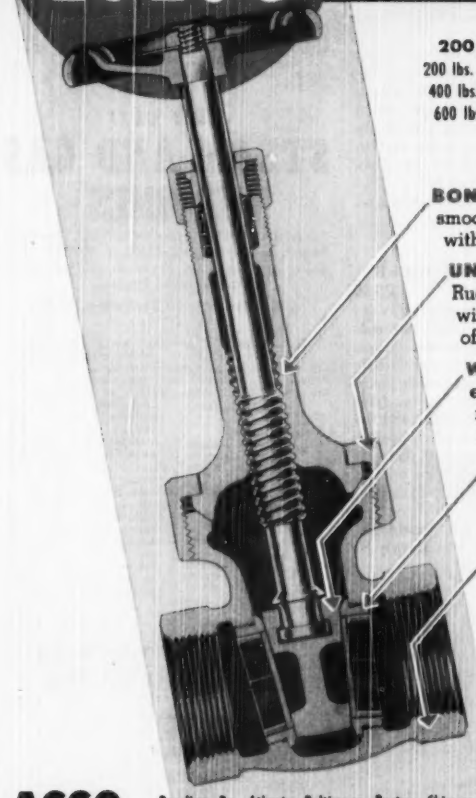
Classified as simplex, single-action reciprocating Nelson chemical-proportioning pumps, their power end has a reversing mechanism or valve gear. This gear consists of a small reversing valve attached to the pump's piston rod. Valve operates an auxiliary liquid or air piston, which drives the pump from a power supply through the main reversing valve.

With a 25-psi power-supply operating pressure, chemicals will discharge at about 100 psi, and at 100-psi operating pressure, chemicals discharge at about 900 psi.



ASK YOUR R·P&C DISTRIBUTOR ABOUT

R·P&C UNION BONNET BRONZE GATE VALVES



200 LB. CLASS	300 LB. CLASS
200 lbs. steam at 500°F.	300 lbs. steam at 550°F.
400 lbs. OWG (non-shock)	600 lbs. OWG (non-shock)
600 lbs. Hydrostatic Test	800 lbs. Hydrostatic Test

Integral Bronze Seats
Nickel Bronze Seat Rings

BONNET P & C High Test Bronze with smoothly machined bevel for tight joint with body.

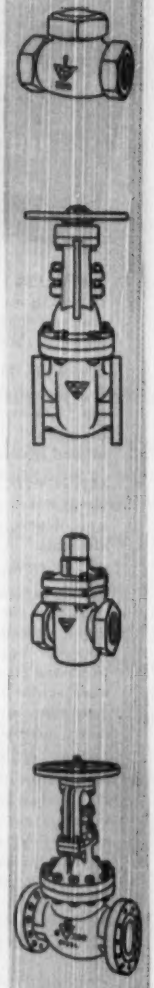
UNION RINGS P & C Valve Bronze. Rugged. Permits repeated disassembly without distortion of body or weakening of threads.

WEDGE Nickel alloy. Reversible. Milled grooves engage guide ribs in body, reducing seat wear. With valve full open, wedge clears line of flow.

SEAT RINGS Nickel alloy (renewable in sizes 1" and larger) or bronze, integral with body.

BODY P & C High Test Bronze. Heavy end hexes. Heavy section and strong threads at union for long service.

Send FOR YOUR COPY OF DH 191

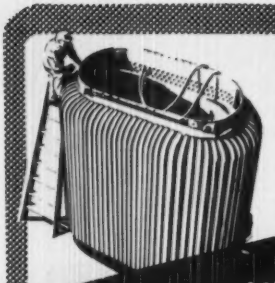


ACCO

Reading, Pa., Atlanta, Baltimore, Boston, Chicago, Denver, Detroit, Houston, New York, Philadelphia, Pittsburgh, San Francisco, Bridgeport, Conn.

R-P & C VALVE DIVISION
AMERICAN CHAIN & CABLE

READING-PRATT & CADY VALVES



higher flow rates FOR transformer cooling coils

PROBLEM: Scale formations impeding water flow in copper coils of 10,000 kva oil transformers, 1900 gals. oil each.

ANSWER: Use recommended solution of Oakite Compound No. 32, fast-acting scale-dissolving agent . . . scientifically inhibited against attack on metal.

EQUIPMENT: Acid - resistant pump, hoses, rubber-lined solution drums, solution heating elements.

RESULTS: Specially engineered Oakite descaling-by-circulation technique shaved hours off previous descaling time. Oakite alkaline neutralizing further protected copper cooling coils after acidic circulation. Water flow rates in each coil importantly increased.

YOUR equipment pressures, temperatures, flow rates should be watched for indications of scale accumulations. Condensers, heat exchangers, rectifiers, regulators require planned Oakite Maintenance cleaning and descaling. Consult Oakite today, or write for full free data in the "71" Digest. No obligation.

OAKITE PRODUCTS, INC.
23 Thames Street, NEW YORK 6, N. Y.

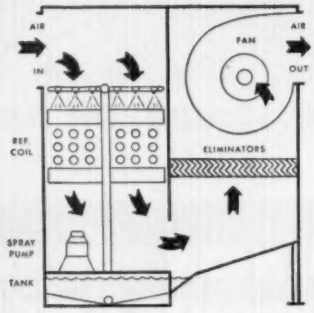
SPECIALIZED INDUSTRIAL CLEANING

OAKITE

MATERIALS • METHODS • SERVICE

Technical Service Representatives Located in Principal Cities of United States and Canada

Pumps' rated capacities are 0.1 and 0.23 gpm at 120 strokes per minute.
Nelson Pumps, Wright Chemical Corp, 627 W. Lake St, Chicago 6, Ill.



SPRAY COOLERS P567

Five unit sizes of spray fan coolers, ranging from 1680- to 11,000-cfm capacity, for refrigerated rooms, have been added to the lines.

Fan section is on side of the unit rather than on top. Air enters the spray section at top, is chilled in passing down through the spray and over the refrigerated coils, enters the fan suction at the bottom and is discharged from the side at top of fan suction. Maximum setting height is 72 in. Floor space ranges from 16 to 72 sq ft.
Niagara Blower Co, 405 Lexington Ave, New York 17, N. Y.

CARBON-MONOXIDE RECORDER P546

MSA carbon-monoxide recorder provides continuous measurement of very low concentrations of carbon monoxide in air. Sampling is implemented by a continuously operating motor-driven pump, which forces the air sample through a dryer and analyzer where carbon monoxide is oxidized and the percentage registered. Recording potentiometer can be equipped with as many as six sets of disks and contacts to operate external circuits at predetermined carbon-monoxide concentrations.
Mine Safety Appliances Co, Braddock, Thomas and Meade St, Pittsburgh 8, Pa.

AIR DIFFUSER P568

Adjustable air deflection from vertical to horizontal feature Model JC *Venturi-Flo* air-supply outlet, which is a combination supply-and-exhaust unit.

Ceiling outlet, supplied in a gray prime coat or a baked *metalescent* aluminum finish, mixes room and supply air for rapid temperature balance.
Barber Colman Co, Rockford, Ill.

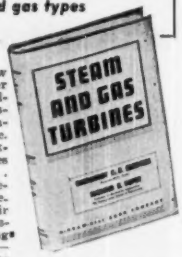
AIR COMPRESSOR P539

Model XLE, L-design, packaged-type heavy-duty, electric-driven, 2-stage compressors, range in size from 125 to 350 hp for continuous full-load service of 80- to 125-psi discharge pressure.

Features synchronous-motor drive with

HOW TO OPERATE AND MAINTAIN TURBINES

—both steam and gas types



CHECK this new book whenever you want "how-and-why" answers to questions on turbine operation and maintenance. It gives a thorough explanation of all phases of the turbine field . . . and includes a clear description of both prime-mover types, as to their arrangement and assembly — the operating principles involved — performance limitations — auxiliary and control devices needed for operation — and the basic reasons for various precautions to be observed. Also spotlighted are outlines of how to estimate performances of new turbines and check existing ones against original guarantees or tests. In short, the book's methods, suggestions and techniques provide you with the kind of on-the-job help you need to keep steam and gas turbines running at peak efficiency.

JUST OUT!

STEAM AND GAS TURBINES

By BERNHARDT G. A. SKROTZKI, Associate Editor, *Power*, and WILLIAM A. VOPAT, Professor of Mechanical Engineering, The Cooper Union School of Engineering

395 pages, 6x9, 357 illustrations, $5.00

YOU'LL find, presented simply and clearly, latest designs of reheat steam turbines, automatic-extraction turbines, small-output gas turbines, and power-gas generators, etc. Then, too, you get complete coverage of all oiling systems from small auxiliary-drive to prime mover types . . . practical guidance on the use of steam tables to calculate actual turbine heat performance . . . and a clear description of the layout and functioning of governor system elements. The nature and variety of design of each turbine element is illustrated, and some typical practical turbine plants described.

Shows . . .
- how to construct nozzles, cylinders, and other turbine parts
- how to overhaul turbines
- how to recondition lubricating oil
- how to install condensers
- how to combine heat - conserving equipment, etc.

SEE THIS BOOK 10 DAYS FREE

McGRAW-HILL

McGraw-Hill Book Co., Inc.
330 W. 42nd St., New York 18

Send me Skrotzki and Vopat's **STEAM AND GAS TURBINES** for 10 days' examination on approval. In 10 days I will remit $5.00, plus few cents for delivery, or return book postpaid. (We pay for delivery if you remit with this coupon; same return privilege.)

Name .....
Address .....
City ..... Zone ..... State .....
Company .....
Position P-5-50

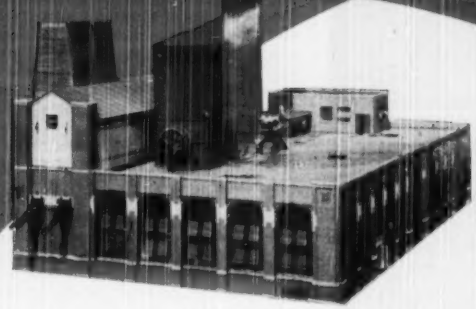
This offer applies to U.S. only.

BURROUGHS ADDING MACHINE COMPANY

have used

DETROIT STOKERS

for 33 years



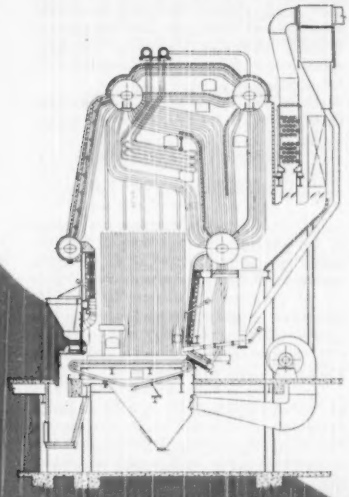
Burroughs Adding Machine Company Plant—Detroit, Michigan. Designed by Albert Kahn Associated Architects and Engineers.

NINE CONTRACTS FOR TWO PLANTS SINCE 1917

Economy of Operation The Keynote of Burroughs Buying Policy

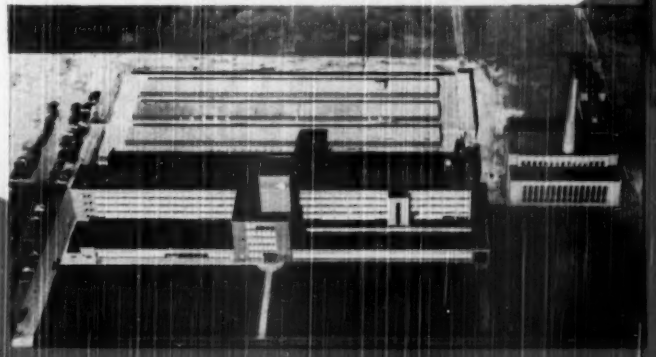
As the Burroughs business has expanded through the years, calling for more capacity; and as fuel specifications have changed, they have continually modernized with Detroit Stokers. Burroughs Plants at Detroit and Plymouth, Michigan, use Detroit RotoGrate and RotoStokers exclusively. A wide range of bituminous coal and coke breeze is efficiently burned.

Why not modernize your plant to reduce steam costs. Our recommendations entail no obligation. Write for information.



Latest Burroughs Installation, Detroit RotoGrate Stoker with Union Iron Works Steam Generator.

Burroughs Adding Machine Company Plant—Plymouth, Michigan. Designed by Albert Kahn Associated Architects and Engineers.



THERE IS A TYPE AND SIZE OF DETROIT STOKER FOR EVERY INDUSTRIAL OR POWER NEED

DETROIT STOKER COMPANY

GENERAL MOTORS BUILDING, DETROIT 2, MICHIGAN

District Offices in Principal Cities . . . Works at Monroe, Michigan

DETROIT STOKERS

4164

FLOATING PYRAMID GEARS

Load distribution that is not only equal to begin with but remains self-equalizing during years of wear! That's the promise, and the practice, of Winsmith's Patented Differential Speed Reducers.

For, Winsmith's unique Floating Pyramid, a 6-gear planetary element, is free within the reducer housing to assume the most effective load distributing position. Thus it portions the load equally over a large total area of helical teeth, assuring quiet, vibrationless operation. In terms of dollars and cents value in your plant, or as a component of equipment you make, Floating Pyramid gears slash reducer maintenance and replacement costs.

REDUCTION RATIOS UNLIMITED

Whether your required reduction is 2:1 or 50,000:1 in transmitting fractional H. P. or 80 H. P., overall dimensions of the compact Winsmith Differential you select from stock, remain the same . . . the number of parts remains the same.

To make your power transmission a still stronger link in your production chain, Winsmith transmission engineers will review your present or projected power systems . . . will help gear your plant to today's demands for higher performance at lower cost, *without obligation.*

★ FREE Booklet 1949 containing complete application data and design illustrations. Write.

WINFIELD H. SMITH CORPORATION

128 EATON ST. SPRINGVILLE, ERIE COUNTY, N. Y.

air intake and discharge passages and intercooler inside the frame. Intercooler is made of copper alloy throughout. Main and crankpin bearings are aluminum alloy with pressure lubrication in a sealed dust-tight crankcase.

Ingersoll-Rand Co, 11 Broadway, New York 4, N.Y.

FIRE EXTINGUISHER P503

Stationary firefighting unit, built in 500- 1000- and 2000-lb capacities, is designed to protect wide areas where minimum manpower is available. One person can operate the stationary unit and fight a fire in any portion of an area several acres in size. System consists of a centrally located steel tank to hold the dry chemical and nitrogen cylinders to pressurize the tank. Piping runs underground from the tank to one or more outlets scattered throughout the area to be protected. Flow rate of dry chemical is 450 lb per min.

Ansul Chemical Co, Marinette, Wis.

PACKAGED AIR CONDITIONER P527

Sealed radial compressor, cushion-mounted, a *Maxi-Fin* cooling coil, two centrifugal fans, mounted on sponge-rubber, are housed in the new 8-ton addition to the company's 2-, 3- and 5-ton packaged air conditioners.

Cabinet, which takes up only 6.5 sq ft of floor space, is heavy 16ge steel, bonderized to resist rust. Automatic low voltage and overload protection is built-in. Adjustable sheave-motor pulleys permit regulation of fan speed.

Airtemp Div, Chrysler Corp, Dayton, Ohio.

Engineer's Bookshelf

(*Continued from page* 154)

This company has developed a system of controlling humidity, with a hygienic liquid absorbent, to serve as an air-conditioning method. Here the moisture is taken out of incoming air directly by a liquid absorbent, Hygol. The end result is to reduce water consumption and refrigeration expense. The absorbent is continually recirculated and reconcentrated.

The system is fully described, a method of load calculations and installation sizing developed, and a typical air-conditioning load-factor questionnaire supplied. Included are detailed forms for data and calculation and curves from which factors can be picked off.

AUTHOR'S GUIDE, *by John Wiley & Sons, 75 pp, 6½x9¼, cloth, $2. John Wiley & Sons, Inc, 440 Fourth Ave, New York 16, N.Y.*

A completely rewritten version of Wiley's, *The Manuscript: A Guide for Its Preparation*, is a start-to-finish manual on handling manuscript, illustrations and proofs. It shows the technical author how his manuscript progresses on its way to publication. Thus the author is acquainted with the functions of several hundred skilled workers required to bring his work into print.

Additional information is included on formal publication and copyright, preparing for reprinting, revisions and new editions

(*Continued on page* 206)

PLANT EQUIPMENT NEWS

Reader Service Page for New Products and Literature

Use the handy FREE service cards for additional information on this month's new products or for copies of latest trade catalogs.

AIR CONDITIONING, HEATING, REFRIGERATION AND VENTILATION

A21 **EVAPORATIVE CONDENSERS** — Frick Co, Waynesboro, Pa. 8-page bulletin No. 234-E outlines advantages and principles of operation of Frick evaporative condensers for ammonia and freon-12 refrigerating systems.

A22 **LOW-TEMPERATURE INSULATION**—Rubatex Div, Great American Industries Inc, Bedford, Va. 20-page design data book No. 37 discusses the use of Rubatex R-103-S insulation hardboard for low-temperature insulation purposes.

A23 **ELECTRIC HEATERS** — Thermel Inc, 3440 W Lake St, Chicago 24, Ill. 4-page folder No. D49 shows many interesting forms of electric heating units for industrial, commercial and domestic use.

A24 **ROOF COOLING** — Ruppright's Rotary Roof Cooler, P O Box 6795, Los Angeles 22, Calif. 4-page reprint tells about roof cooling—what it can do and how it is done.

A25 **REFRIGERATING MACHINES** —Frick Co, Waynesboro, Pa. 4-page bulletin No. 196-G features several types of Frick refrigerating machines.

BOILERS AND AUXILIARIES

B38 **STEAM AUXILIARIES**—Texas Co, 135 E 42nd St, New York 17, N. Y. 12-page section, entitled "Steam Power Plant Auxiliaries," of the company's April 1950 issue of "Lubrication" tends to indicate how lubrication of the auxiliaries is related to over-all performance of the plant.

B39 **DUST COLLECTORS** — General Electric Co, Schenectady 5, N. Y. 16-page catalog No. GEA-5213 explains how electrostatic precipitation works and gives case histories of 7 typical installations.

B40 **GAS COMBUSTION** — Eclipse Fuel Engrg Co, Rockford, Ill. Single-sheet No. H-115 features McKee-Eclipse gas burning equipment for furnaces, ovens, tanks, and other industrial heating processes.

B41 **FUEL OIL TREATMENT** — Power Chemicals Div, E F Drew & Co, Inc, 15 E 26th St, New York 10, N. Y. Technical folder, entitled "Fuel Oil Treatment and Sludge Removing," describes the means of preventing or correcting unsatisfactory conditions in storing, handling, pumping, heating and burning of industrial fuel oil.

B42 **DUST CONTROL** — Ducon Co, Mineola, N. Y. 12-page booklet No. DC 49-145 points out construction and operating features of Duclone collectors. Illustrates efficiency curves, schematic drawings of different industrial applications, etc.

CONTROLS, ELECTRIC

D20 **PHOTOELECTRIC CONTROL** — Photoswitch Inc, 77 Broadway, Cambridge 42, Mass. Bulletin No. PA-418 gives informative data on the new Photoswitch photo-electric control Series 20 designed for general industrial and machinery application. Specifications are included.

D21 **ROTARY SWITCH** — Electro Switch Corp, 167 King Ave, Weymouth 88, Mass. 12-page catalog

HOW TO ORDER ADDITIONAL DATA

Be sure to fill out, completely, one coupon for each item of information you order. (See sample, right.) This gives your request authority and helps the manufacturer to address your copy completely.

When you have filled out completely one space for each item of information you want, detach along the scored lines and drop the cards in the mail.

Example

Write here number of item in which you are interested → E17

Your Company Name: Brown Mfg Co.
Address: 3718 First Avenue
Pottsville, Okla.
Your Name: John Smith
Your Title: Power Engineer

POWER, 330 West 42nd St., New York 18, N. Y.

FILL OUT AND MAIL TODAY! NOT GOOD AFTER AUG 1, 1950

Write here number of item in which you are interested →

Your Company Name
Address
Your Name
Your Title
POWER, 330 West 42nd St., New York 18, N. Y. 5/50

Write here number of item in which you are interested →

Your Company Name
Address
Your Name
Your Title
POWER, 330 West 42nd St., New York 18, N. Y. 5/50

Write here number of item in which you are interested →

Your Company Name
Address
Your Name
Your Title
POWER, 330 West 42nd St., New York 18, N. Y. 5/50

Write here number of item in which you are interested →

Your Company Name
Address
Your Name
Your Title
POWER, 330 West 42nd St., New York 18, N. Y. 5/50

Write here number of item in which you are interested →

Your Company Name
Address
Your Name
Your Title
POWER, 330 West 42nd St., New York 18, N. Y. 5/50

Write here number of item in which you are interested →

Your Company Name
Address
Your Name
Your Title
POWER, 330 West 42nd St., New York 18, N. Y. 5/50

No. 1950-P of ESCO Type P rotary switches gives detailed, up-to-the-minute information on the use of these multi-pole, snap switches for a wide variety of services in control and transfer of electric circuits.

CONTROLS, MECHANICAL

E16 **COMBUSTION CONTROL** — Combustion Control Corp, 77 Broadway, Cambridge 42, Mass. Booklet No. CH 4752 discusses the company's new flame failure safe-guard for light-oil burner. Specifications are given.

E17 **INSTRUMENT AND CONTROL PANELS**—Hays Corp, Michigan City, Ind. 8-page folder No. 773 explains how Hays panels are made and where they are used. All operations of fabrication are discussed and illustrated—layout, cutting, drilling, welding, fitting, painting, wiring, etc.

ELECTRICAL EQUIPMENT

F64 **OIL CIRCUIT BREAKERS** — Allis-Chalmers Mfg Co, 953 S 70th St, Milwaukee, Wis. 4-page folder No. 71B6093C covers Types OZ-110 and OZ-210 moderate capacity oil circuit breakers of quick-clearing, non-oil-throwing design for outdoor distribution service where reliable and safe operation is required without frequent adjustment or inspection.

F65 **SYNCHRONOUS MOTORS** — General Electric Co, Schenectady 5, N. Y. 8-page booklet No. GEA-5332 presents low-speed synchronous motors. Illustrates typical installations of these high-power factor, constant-speed drives. Also describes their construction features, and indicates mechanical modifications and performance data.

F66 **STORAGE BATTERIES**—Gould Storage Battery Corp, Trenton 7, N. J. 4-page leaflet No. GB933 gives detailed instructions on the installation and operation of glass jar batteries for stand-by service, control, telephone, telegraph, emergency lighting, fire alarm and other stationary installations.

F67 **FITTINGS AND DEVICES** — Buchanan Electrical Products Corp, 1290 Central Ave, Hillside, N. J. 12-page catalog features solderless connectors, cable and conduit fittings and wiring devices. Illustrations, dimensional data and application instructions are included.

F68 **TRANSFORMERS** — Erie Electric Co, 120 Church St, Buffalo, N. Y. 12-page bulletin No. 4001-150P shows several types of Niagara transformers. These include: oil-immersed self-cooled; dry air blast; combination oil-immersed self-cooled, forced air-cooled; and non-inflammable liquid self-cooled types.

F69 **ELECTRIC INSULATION** — M W Kellogg Co, Chemical Mfg Div, P O Box 469, Jersey City, N. J. Technical booklet No. 1-12-49 describes physical and mechanical properties of the KEL-F, fluorocarbon-type thermoplastic, non-wetting, high dielectric strength insulation.

F70 **DISTRIBUTION TRANSFORMER** — Allis-Chalmers Mfg Co, 953 S 70th St, Milwaukee, Wis. 8-page leaflet No. 61B7309A gives mechanical data and 5 type designations of the ACP distribution transformer, along with a typical load-time curve for one of the units. Ratings range from 3 through 100 kva—2,400 to 14,400 volts.

F71 **STOCK LIST**—Duquesne Electric & Mfg Co, Broad St & Hamilton Ave, Pittsburgh 6, Pa. 48-page current catalog lists specifications and prices for new and used ac motors, gearhead motors, speed reducers, dc and variable speed motors, transformers, ac and dc generators, mg sets, engine-generator sets, motor starters, pumps, fans and blowers, air compressors.

HEAT EXCHANGERS

G6 **STEAM-JET DEAERATORS** — Worthington Pump & Machy Corp, Harrison, N. J. 8-page publication No. W-210-B29 describes the Worthington steam-jet deaerators. Operation data and construction features are explained in detail.

G7 **SHELL AND TUBE HEAT EXCHANGERS** — Young Radiator Co, Racine, Wis. 8-page bulletin No. 1149 tells about new Young Type R (removable tube bundle) shell and tube heat exchangers. Capacities and dimension tables for single- and 2-pass coolers are included.

G8 **EVAPORATIVE COILS** — Binks Mfg Co, 3123 Carroll Ave, Chicago 12, Ill. 4-page folder No. 41 presents informative data on Binks Type D evaporative heat exchange coils, including dimensions, total effective surface, and weights for 17 sizes.

G9 **CONVERTERS** — Davis Engrg Corp, 1064 E Grand St, Elizabeth 4, N. J. 12-page catalog No. 70—Section K features Paracoil converters. 88 standard sizes are described with full dimensional data and capacity ratings.

G10 **HEAT TRANSFER TUBES** — Babcock & Wilcox Tube Co, Beaver Falls, Pa. Bulletin No. TB-32B covers heat exchanger and condenser tubes. Specifications are offered in table form on carbon, low chromium, intermediate chromium, nickle and stainless steels.

MAINTENANCE AND SAFETY EQUIPMENT

K27 **TUBE CLEANERS**—Elliott Co, Lagonda Div, Springfield, Ohio. 28-page book No. Y-29 covers applications of Lagonda tube cleaners for removing scale and other types of encrustation from tubes or pipes in boiler room equipment, oil refineries, process plants, and other locations.

K28 **PIPE AND BOLT MACHINES**—Beaver Pipe Tools Inc, Dana Ave, Warren, Ohio. 4-page folder, entitled "What Users Say About Beaver Model-A Pipe & Bolt Machines," contains comments on the use and qualifications of the Model-A power driven pipe and bolt machine.

K29 **EXTINGUISHER INSPECTION** —Ansul Chemical Co, Marinette, Wis. Company has designed a periodic inspection chart that helps fire inspectors keep accurate records of their extinguishers. Space for 24 inspections of up to 32 extinguishers is provided. Available upon request.

K30 **FIRE HAZARD INDEX**—Randolph Laboratories Inc, 8 E Kinzie St, Chicago 11, Ill. 36-page, pocket-sized, fire hazard index lists, in quick-reference alphabetical order, over 590 chemical, gas and common fire hazard materials.

MAINTENANCE MATERIALS

L48 **LOCKNUTS AND LOCKWASHERS**—Link-Belt Co, 307 N Michigan Ave, Chicago 1, Ill. 4-page

(*Continued on page 194*)

FIRST CLASS
PERMIT No. 64
(Sec. 34.9, P.L. & R.)
NEW YORK, N.Y.

BUSINESS REPLY CARD
NO POSTAGE STAMP NECESSARY IF MAILED IN THE UNITED STATES

4c. Postage Will Be Paid by—

POWER

330 West 42nd Street

New York 18, N. Y.

FIRST CLASS
PERMIT No. 64
(Sec. 34.9, P.L. & R.)
NEW YORK, N.Y.

BUSINESS REPLY CARD
NO POSTAGE STAMP NECESSARY IF MAILED IN THE UNITED STATES

4c. Postage Will Be Paid by—

POWER

330 West 42nd Street

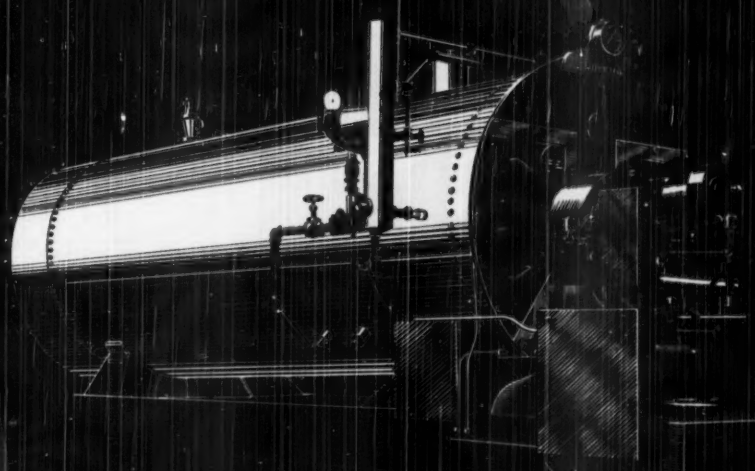
New York 18, N. Y.

FOR THOSE WHO DEMAND

Something More

. . . than ordinary steam generator performance, SUPERIOR Steam Generators provide the answer . . . and that "something more" is **more** rugged construction; **more** heating surface, **more** steam area, **more** weight per horsepower; **more** accurate control of fuel and air ratios; **more** dependable combustion equipment; **more** years of operation at peak efficiency . . . all of which adds up to 80% or more thermal efficiency which lasts, and lasts. For a steam generator is a long term investment with high dividends when you buy a . . .

STEAM GENERATOR



Get the facts. Write today for your copy of our new catalog 201.

uperior ombustion ndustries, inc.

Factory, Emmaus, Pa.

Executive Offices, Times Tower, Times Square, New York 18, N. Y.

Where You'll Find Proof Of The Experience Behind . . .

BOILERS BY

Some Typical Installations of Boilers By Bigelow

THE STANLEY WORKS, New Britain, Conn.
50,000 lb. per hour . . . oil fired

A. G. SPALDING & BROS., INC., Chicopee, Mass
40,000 lb. per hour . . . oil

STANFORD UNIVERSITY, Palo Alto, Calif.
40,000 lb. per hour . . . oil & gas

ST. MARY'S SUGAR, Sorel, La.
45,000 lb. per hour . . . bagasse

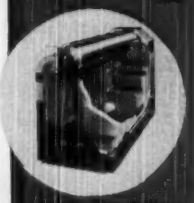
BARTGIS BROTHERS, Ilchester, Md.
60,000 lb. per hour . . . coal

GENERAL E. L. LOGAN AIRPORT, E. Boston, Mass.
65,000 lb. per hour . . . oil

CHINA AMERICAN PAPER CO., Shanghai, China
20,000 lb. per hour . . . oil

INTERNATIONAL SILVER CO., Wallingford, Conn.
30,000 lb. per hour . . . oil

PETER PAUL, INC., Philippine Islands
12,000 lb. per hour . . . coconut husks



Throughout industry, Bigelow boilers are piling up service records of efficient steam production. Each successful installation is further evidence of Bigelow's boiler-making experience. Each is operating proof of Bigelow's ability to build boilers to answer a wide range of steam requirements.

Every one of the hundreds of Bigelow boilers holding down vital power jobs is another reason for you to consider Boilers By Bigelow for your plant.

Write for free catalogs on any of the units listed here.

BOILERS BY BIGELOW
Water Tube Boilers — Bent Tube Types
Horizontal Return Tubular Boilers
Scotch Type Boilers
Two-Pass Boilers
Electric Steam Generators

THE BIGELOW COMPANY • NEW HAVEN 3, CONN.
Established 1833

BIGELOW REPRESENTATIVES: Boston • New York • Philadelphia • Syracuse • Detroit • Chicago • Pittsburgh • Milwaukee New Orleans • Baltimore • Petersburg, Va. • Washington, D. C. Albuquerque • Seattle • Sumter, S. C.

folder No. 2348 describes the company's new line of bearing-positioning locknuts and lockwashers, specially designed for effectively locking various makes of ball and roller bearings in correct position on shafts of 5/16 to 7 11/16 in. diameter.

L49 **CORROSION-RESISTANT LININGS**—Carboline Co, 7603 Forsyth Blvd, St. Louis 5, Mo. Two bulletins tell about lining of wood and steel storage and process tanks for handling corrosives. No. C-6A discusses repairing and lining of wood tanks and No. C-7 tells how to line steel tanks with Carbo-Flex.

All literature designated with a star (★) may be obtained only by writing direct to the manufacturer on company letterhead, giving writer's name and title.

★ **ALUMINUM PAINT** — Aluminum Co of America, 661 Gulf Bldg, Pittsburgh 19, Pa. 32-page brochure No. AD-228 gives informative data on aluminum paint, including advantages, selection, description of 3 main types, suggestions for best results and uses on various surfaces.

L50 **PACKING RINGS**—Sims Pump Valve Co, Inc, 145 Hudson St, New York 13, N. Y. 4-page leaflet No. R-111 covers Simsite graphite packing rings which are non-metallic composition snap-rings for packing liquid-end pistons of reciprocating pumps.

L51 **RUST CONTROL**—International Rustproof Corp, 12507 Plover Ave, Cleveland, Ohio. 6-page engineering data sheet, entitled "Field Information on the Arrest and Control of Rust," explains in layman's language the causes, effect and proper means for control of rust.

L52 **PROTECTIVE COATING**—Bisonite Co, Inc, 128 Lakeview Ave, Buffalo 1, N. Y. 14-pages of data sheets discuss Bisonite "M", a solution of very inert thermalplastic resins which have been combined under heat and pressure to form a coating which will resist corrosive effects of most strong acids, salts, and alkalis.

MATERIALS HANDLING

M32 **HAND HOISTS**—Wright Hoist Div, American Chain & Cable Co, Inc, York, Pa. 6-page folder No. DH-164 contains information on the new line of Wright Safeway hand hoists. Complete specifications, action photographs, a cross sectional view, graphic illustrations, and a list of its features are included.

M33 **POWERHOUSE CRANE**—Whiting Corp, Harvey, Ill. 8-page bulletin Sec 300-Unit 73 illustrates the variety of cranes built by Whiting for service in the power industry. A partial list of over 350 powerhouse crane installations is given.

M34 **AIR EXPRESS** — Air Express Div, Railway Express Agency, 230 Park Ave, New York 17, N. Y. 26-page pamphlet, entitled "Reference File of Air Express Uses," relates in convenient card index form, some case histories telling how Air Express transportation is helping American business and industry to keep ahead of competition and how to expand the markets for their products.

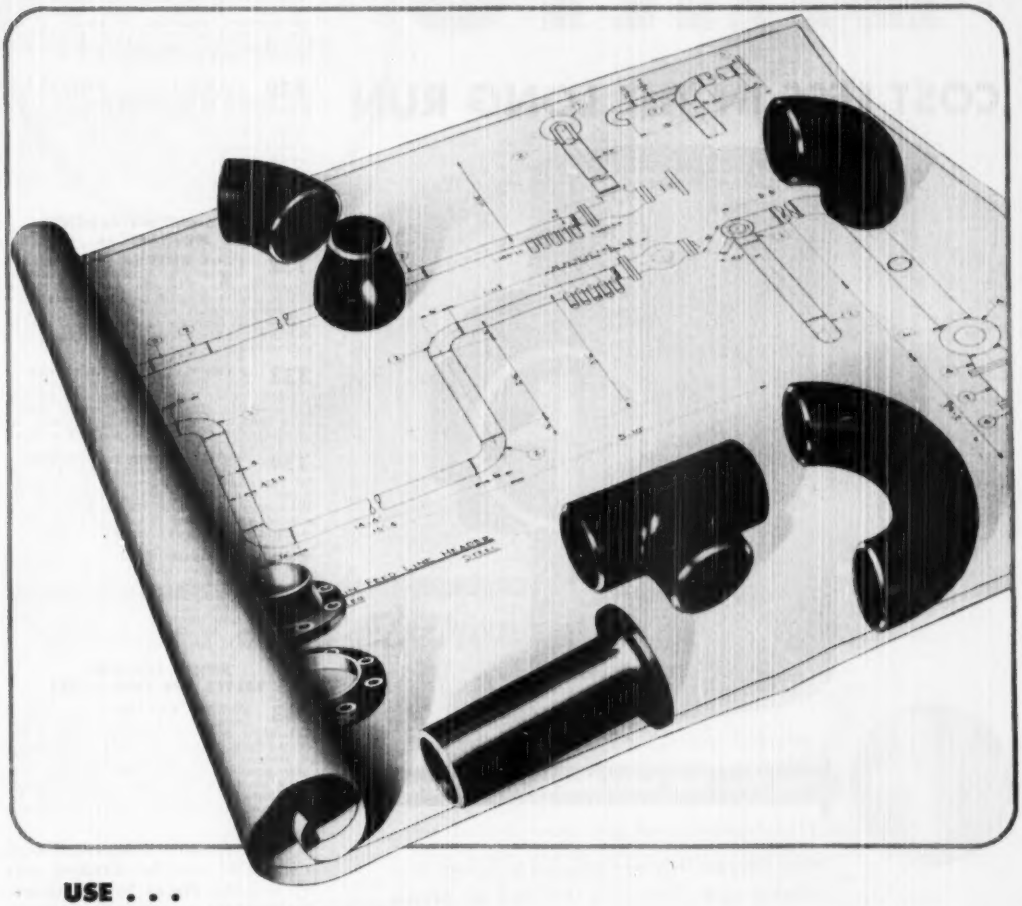
M35 **ASH HANDLING**—John Thompson Conveyor Co, Ettingshall, Wolverhampton, England. 4-page folder features the John Thompson submerged belt ash conveyor. Descriptive data is given, as well as a cross-section view.

MECHANICAL TRANSMISSION

N23 **SPEED REDUCER** — Dodge Mfg Corp, Mishawaka, Ind. 16-page brochure No. A-470 presents the new Dodge Torque-Arm speed reducer augmented by full-size photos of the entire mechanism and simplified selection tables.

N24 **SLEEVE TYPE BEARINGS** — Buckeye Brass & Mfg Co, 6410 Hawthorne Ave, Cleveland 3, Ohio. Catalog No. 480 contains sections de-

TO DO A BETTER PIPING JOB . . .



USE . . .

GLOBE PRECISION PROCESS SEAMLESS WELDING FITTINGS

When you specify and use Globe Welding Fittings you have the product of an organization with unusually broad metallurgical experience. Globe's precision-process method of production reaches back to the manufacture of the Globe seamless tubes themselves which are the "raw material" of Globe welding fitting fabrication.

GLOBE STEEL TUBES CO., Milwaukee 4, Wisconsin

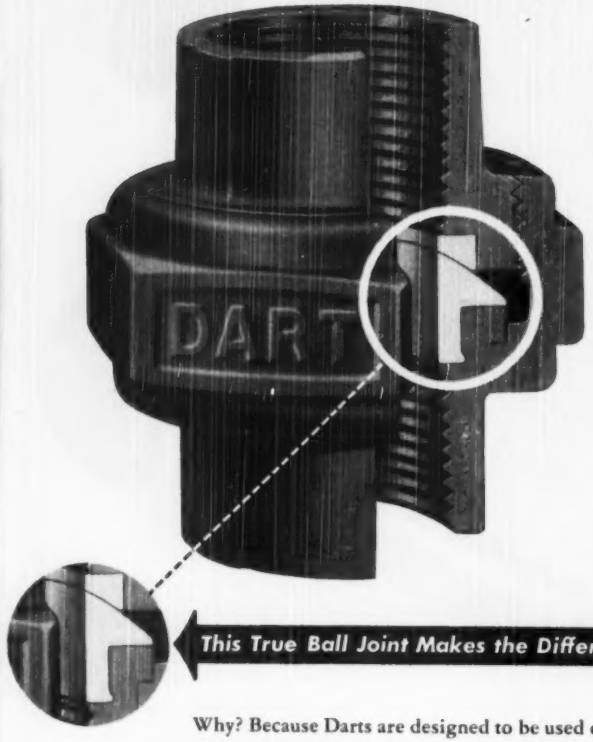
Chicago • Minneapolis • Cleveland • Detroit • New York • Philadelphia St. Louis • Tulsa • Houston • Denver • San Francisco • Glendale, Cal.

Producers of Globe seamless stainless steel tubes — Gloweld welded stainless steel tubes — carbon — alloy — seamless steel tubes — Globeiron seamless high purity ingot iron tubes — Globe Welding Fittings.

Send for the Globe Welding Fittings Catalog—and look to Globe as a preferred source of supply.

DARTS

COST LESS IN THE LONG RUN



This True Ball Joint Makes the Difference

Why? Because Darts are designed to be used over and over again. First of all, they have two bronze seats spherically ground to form a true ball joint. Thus, they tighten easily — form a drop-tight connection without excessive wrenching. No need to stretch or jam the seats. And once in place, the practically indestructible, air-refined, malleable iron of body and nut shrugs off tough abuse. Uncouple them whenever you want — use them over and over again.

E. M. DART MFG. CO.
Providence 5, Rhode Island

DART
UNIONS

voted to progressive size and numerical listing of over 1000 standard stock bearings; 270 sizes of popular 13-in. fully machined maintenance bars, etc.

METALS AND ALLOYS

R19 **HIGH TEMPERATURE STEELS** —U. S. Steel Corp, 429 Fourth Ave, Pittsburgh 19, Pa. 88-page book, entitled "Steels for Elevated Temperature Service," consists of several sections dealing with measurement of flow under stress at elevated temperature; factors affecting high temperature properties; behavior of steels at elevated temperature; tabular and graphical data; and facilities for research, development and testing.

R20 **CORROSION-RESISTANT ALLOYS**—Haynes Stellite Div, Union Carbide & Carbon Corp, Kokomo, Ind. 40-page catalog, entitled "Hastelloy High-Strength, Nickel-Base, Corrosion-Resistant Alloys," tells complete story of the 4 Hastelloy alloys—what they are, how they can be fabricated, and also how they can be used to combat severe corrosion.

METERS AND INSTRUMENTS, MECHANICAL

T32 **FLOWMETERS** — Fischer & Porter Co, 83 County Line Rd, Hatboro, Pa. 12-page bulletin No. 83 describes the firm's new Ratosleeve flowmeters suitable for liquids, gases, pulps and slurries. Advantages, specifications, dimensions and illustrations are given.

T33 **PNEUMATIC OPERATORS** — Conoflow Corp, 2100 Arch St, Philadelphia 3, Pa. 8-page technical booklet No. 104 covers design, operation and application of pneumatic operators for throttling control service.

T34 **STRIP-CHART RECORDER** — Wheelco Instruments Co, 847 W Harrison St, Chicago 7, Ill. Supplement to bulletin C2-1 features the Wheelco pneumatic Capacilog, air-operated strip-chart recorder. Data sheet outlines operation and applications.

T35 **CHRONOSCOPE** — American Chronoscope Corp, 316 W First St, Mt Vernon, N. Y. 4-page folder illustrates and describes the company's electronic-mechanical Chronoscopes, input adapters and photoelectric adapters for measuring significant operating times from 10 microseconds to 3 seconds.

PIPING, FITTINGS, VALVES AND SPECIALTIES

U43 **FLUSH VALVES** — Coyne & Delany Co, 834 Kent Ave, Brooklyn 5, N. Y. 36-page catolog No. 49 outlines clearly the wide application of Delany flush valves for every ordinary and special installation. Also contains installation data, piping design and data, piping data tables and descriptions of various types of Delany valves.

All literature designated with a star (★) may be obtained only by writing direct to the manufacturer on company letterhead, giving writer's name and title.

★ **SAFETY VALVES**—Marine & Industrial Products Co, 3731-35 Filbert St, Philadelphia 4, Pa. 12-page folder No. 250 contains test data and charts together with capacity tables of various models of MIPCO safety valves.

U44 **PUMP VALVE** — Sims Pump Valve Co, Inc, 145 Hudson St, New York 13, N. Y. 4-page leaflet No. V-111 discusses the Sims inclined port rotating pump valve. Essential features are shown in a diagram drawing.

U45 **VALVE-SIZING CHARTS** — Fischer & Porter Co, Dept 7007, Hatboro, Pa. Single-sheet supplement No. 2, Catalog 70, consists of liquid and gas valve-sizing charts, covering the ranges of 0.02 to 10,000 gallons per minute and 1 to 100,000 pounds per hr, respectively.

U46 **MECHANICAL TUBING** — Babcock & Wilcox Tube Co, Beaver Falls, Pa. Bulletin No. TB-324 describes

ONE-STOP READING OF CRITICAL TURBINE TEMPERATURES

TURBINE EXHAUST • BLEED STEAMS • CONDENSATE • CIRCULATING WATER

BEARING OIL • THROTTLE STEAM

with the *ElectroniK* PRECISION INDICATOR

LIKE a scientific "crystal ball," the *ElectroniK* Precision Indicator permits you to keep in touch with conditions throughout the turbine. You can tell, at a glance, the exact temperature of the location "tuned in" by the button you push.

The *ElectroniK* method is the new, modern way to check important temperatures. It affords convenient, trouble-free reading from a central location . . . through a network of extension wire and thermocouples. It is fast and accurate . . . it requires a minimum of attention . . . it is insurance for continuous, safe and economical operation of the steam generation plant.

Call in your local Honeywell engineer for detailed information . . . he is as near as your phone. Ask him, too, about the special Brown Training School . . . available for the education of your employees.

Write, today, for a copy of Bulletin #90-1!

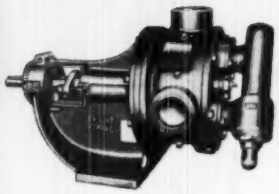
COMMERCIAL • RESIDENTIAL • INDUSTRIAL
WORLD'S LARGEST ORGANIZATION FOR ADVANCED INSTRUMENTATION AND CONTROL

MINNEAPOLIS-HONEYWELL REGULATOR CO.
INDUSTRIAL DIVISION
4490 Wayne Ave., Philadelphia 44, Pa.
Offices in 77 principal cities of the United States, Canada and throughout the world

Honeywell — *Advanced Instrumentation* FOR BETTER PROCESSING — BROWN

VIKING

FEATURES THAT MAKE FOR GOOD PUMPING



1. **ONLY TWO MOVING PARTS.** Both large and rugged and each self-supported. No small intricate parts requiring frequent replacement.

2. **SELF PRIMING** on suction lifts up to 20 feet or vaporization limits on volatile liquids. Smooth, even discharge. No pulsation.

3. **SLOW SPEED—LONG LIFE.** Reduced speeds of Viking pumps prolongs life and still retains large volume.

4. **OPERATES IN BOTH DIRECTIONS.** Viking pumps operate equally well in both directions. Simplifies ordering and installation.

5. **SINGLE STUFFING BOX.** Long, leak resistant, stuffing box. Easily serviced.

VIKING
AN HONORED NAME IN PUMPING

Get the complete story on Viking Pumps for the power equipment field today. Send for free copy of bulletin series 505W.

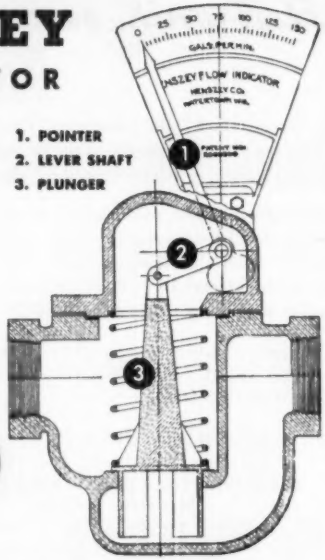
Viking PUMP COMPANY
Cedar Falls, Iowa

See Our Catalog In SWEETS

Only 3 MOVING PARTS *in the* HENSZEY FLOW INDICATOR

There are only three moving parts in the Henszey Flow Indicator—the Pointer, the Lever Shaft and the Plunger. And that means longer wear, continued service, and constant accuracy.

The liquid enters the indicator below the plunger, forcing the plunger upward. Slots in the side of the plunger allow the liquid to pass. Increased flow will increase the lift, exposing a greater area of the slots, so that the lift of the plunger is in direct proportion to the rate of flow of the liquid. The graduations on the dial are uniformly spaced from one end to another and read direct — without constants. The entire instrument can be installed right in the pipe line.



1. POINTER
2. LEVER SHAFT
3. PLUNGER

For details consult Sweet's Catalog or write:

HENSZEY COMPANY
Dept. D-5, WATERTOWN, WISCONSIN

HENSZEY
FLOW INDICATORS

Continuous Blowdown • Distillation Systems • Heat Exchangers
Feed Water Meters • Boiler Feed Regulators • Proportioning Valves
also MILK EVAPORATORS and PRE-HEATERS

ways in which increased production, lower manufacturing costs and short cuts to improved design may be reached by taking advantage of an unusual service embracing the complete range of steel tubing available to industry.

U47 **PISTON VALVES** — Klingerit Inc, 16 Hudson St, New York 13, N. Y. 22-page booklet gives list prices, specifications, mechanical cross-sections, illustrations, and parts list of Strahman seatless piston valves.

PRIME MOVERS AND ACCESSORIES

V21 **DIESEL ENGINES**—Worthington Pump & Machy Corp, Engine Sales Div, P O Box 953, Buffalo 5, N. Y. 4-page publication No. S-500-E-1-500 permits quick determination of lowest power costs by visual inspection. Information is imparted by a family of curves covering gas cost per 1000 cu. ft. for dual fuel and gas diesel, as well as spark ignition gas; and oil cost per gallon for oil diesel.

V22 **SINGLE-STAGE TURBINE** — De Laval Steam Turbine Co, Trenton 2, N. J. 4-page folder No. 4215 contains complete description and specifications of a new single-stage mechanical drive De Laval CP turbine suitable for pressures to 1450 psig, initial temperatures to 950 FTT and back pressures to 300 psig.

PUMPS

W34 **CENTRIFUGAL PUMPS** — Pacific Pumps Inc, 5715 Bicket St, Huntington Park, Cal. 16-page brochure No. 109 explains design and construction of Pacific centrifugal pumps for boiler feed service. Cross-sectional views and illustrations of typical installations are included.

W35 **SUMP PUMPS**—Penberthy Injector Co, 1242 Holden Ave, Detroit 2, Mich. Single-sheet form No. 4929 shows the Penberthy explosion proof and totally enclosed automatic electric sump pump. Retail prices, sizes, pipe connections, capacities, etc, are listed.

W36 **DUAL VANE PUMPS** — Dudco Products Co, 1796 E Nine Mile Rd, Hazel Park, Mich. Broadside features Dudco "E" Series of dual vane pump for users of smaller hp drives.

W37 **JET PUMP**—Penberthy Injector Co, 1242 Holden Ave, Detroit 2, Mich. 4-page folder No. 5030 cites performance, specifications and uses of Penberthy cycling jet pump operated by air, gas or steam pressure.

WATER TREATMENT

X15 **CHEMICAL CONTROL** — Dearborn Chemical Co, 310 S Michigan Ave, Chicago 4, Ill. 24-page booklet No. 5000 covers the principles and fundamentals of providing trouble-free water in boiler plant operation, for prevention of scale, pitting and general corrosion, for producing pure, dry steam and to avoid caustic embrittlement.

X16 **WATER SOFTENERS**—Graver Water Conditioning Co, Dept 103, 216 W 14th St, New York 11, N. Y. 36-page catalog No. WC-102 explains boiler plant troubles caused by various impurities in water, outlines 12 different methods of treating water to eliminate these impurities, and explains chemistry of hot-process water softening and its advantages.

X17 **CHEMICAL FEEDERS**—Black, Sivalls & Bryson Inc, 720 Delaware, Kansas City 6, Mo. 16-page bulletin, entitled "Automatic Chemical Feeders," presents operation, special features, and standard specifications of BS&B automatic chemical feeders.

OTHER EQUIPMENT

Z52 **AIR CYLINDERS**—Rivett Lathe & Grinder Inc, Brighton 35, Boston, Mass. 16-page booklet No. 54 illustrates and describes entire line of Cerotor air cylinders. Drawings and tables are furnished for each model.

Z53 **VIBRATION CONTROL** — Korfund Co, Inc, 48-48-E 32nd Place, Long Island City 1, N. Y. 4-page folder No. G-102 gives data on vibration control materials and isolation selector

INTERNAL OR EXTERNAL BOILER WATER TREATMENT?

FIGHTIN' WORDS? Well, not exactly . . . but certainly a frequent cause of dispute in the front office as well as in the boiler room! Which method is the most practical . . . the most efficient . . . the most economical?

There is no general rule that can be followed. Present-day practice says "External treatment is often desirable—but internal treatment is always necessary." However, every case is different and must be considered on its own merit. That's why so many engineers depend on the Drew System of Water Treatment for the correct answer.

The Drew System of Water Treatment eliminates guesswork! It starts with proper diagnosis. It includes recommendations for corrective treatment and other preventive measures such as modification of operating cycles and redesign of equipment, if required. It is specialized service applied to your individual boiler problem.

Don't gamble with guesses! Consult the Drew Engineer or write for further information.

POWER DREW CHEMICALS

Power Chemicals Division

E. F. DREW & CO., INC.

15 East 26th Street, New York 10, N. Y.

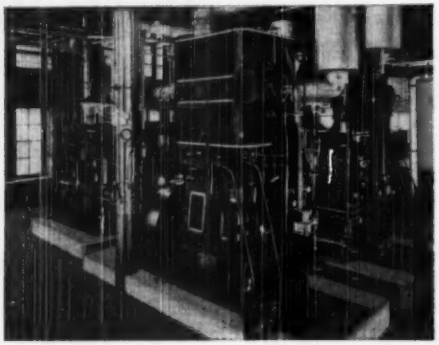
Nationwide service in Boiler Water and Cooling Water Conditioning

DREW PRODUCTS

TWO MORE

SKINNER "UNIVERSAL UNAFLOW" STEAM ENGINES

in Burger Brewery's Expansion Program



Two 2-cylinder Skinner Vertical "Universal Unaflow" Steam Engines driving two 400-ton ammonia compressors.

The Burger Brewing Company has the largest single-plant brewery in the state of Ohio. Established in 1874, Burger brews and slogan have become famous from coast to coast. The huge new bottle shop building and additions to brewing equipment have brought its capacity to more than one million barrels annually.

Two new Skinner "Universal Unaflow" Vertical Steam Engines drive two 400-ton variable-speed ammonia compressors. A floor space of only 15 x 25 feet is required for this compact dual engine and compressor installation.

Skinner "Universal Unaflow" Engines were chosen for this new installation, on the basis of the highly successful performance of two horizontal "Universal Unaflow" Steam Engines which have been Burger's chief source of electric power for many years. Exhaust steam from the four engines is used for generating all hot water, including pasteurization and boiler feed, and for brew and space heating.

Skinner "Universal Unaflow" Engines have long been popular for brewery service. They are also providing dependable, economical power for thousands of other processing and manufacturing plants, office buildings, hotels, schools, hospitals and other institutions. Write for detailed information on the advantages of Skinner "Universal Unaflow" Steam Engines in your field.

For Over 80 Years | Doing One Thing Well — Building Steam Engines

SKINNER ENGINE COMPANY, ERIE, PA.

chart. 50 typical machine and equipment applications are tabulated with recommendations for proper types of vibro-isolators for highest efficiency, and with alternates for satisfactory operating efficiency for less exacting requirements.

Z54 **ASPHALT MASTIC FLOORING** —Ralph V Rulon Inc, 3900 N 2nd St, Philadelphia 40, Pa. 8-page catalog contains full information concerning Rulon asphalt mastic floors which are acid-resisting, waterproof, slip-proof and long-wearing.

Z55 **JOB-PLANNING** — Arthur D Little Inc, 30 Memorial Drive, Cambridge 42, Mass. Bulletin outlines ways that staff, combining skill and experience in handling business problems with professional competence in technology, can provide facts needed to guide industrial decisions.

Z56 **WELDING ELECTRODES** — Eutectic Welding Alloys Corp, 40 Worth St, New York 13, N. Y. 2 publications are offered. Form No. EU-19 discusses some interesting aspects of arc welding stainless steel with new Eutectic Stainrodes, illustrated with verified case histories. No. EU-31 describes the EutecRod 190, a high-strength thin-flowing welding alloy for aluminum.

Z57 **WIRED TELEVISION** — Diamond Power Specialty Corp, Lancaster, Ohio. 16-page booklet No. 1025 features the Diamond "Utiliscope" —wired television. Applications in various industries are clearly illustrated and the advantages and possibilities of its uses are listed.

GAS TURBINES

(*Continued from page* 82)

coal side ignites next and unit accelerates still further. By turning on coal, unit can be brought up to its rated speed of 5180 rpm. On occasion, it has run up to its maximum permissible speed of 6000 rpm. At 10% overspeed, or 5700 rpm, overspeed trip valve comes into action, bypassing the turbine and opening the anti-pumping valve. An emergency stop of this kind is made at end of each day's operation.

Speed of the unit forms the primary variable. Operator keeps this at a predetermined value by adjusting fuel flow. Only load on the machine is the air blown down from the flyash-separation equipment, and an additional amount that is discharged through the control valve. Normally, speed remains constant, despite variations in combustor outlet temperature of 25 F above and below mean value.

Future Work. Houdry unit was installed for a dual purpose: (1) to demonstrate that coal can be used successfully for a full-scale gas turbine, and (2) as a research installation, to develop better coal-handling, combustion and flyash-removal equipment. At present, it operates as many hours each week as possible to determine effect of unremoved fine dust on turbine blades. After first 250 hr of operation, inspection of moving blades showed no damage whatsoever. Some localized erosion occurred in first-row stationary blades, but causes and cures for this condition are known. A very thin layer of

In all the world there's only one TUBE-TURN *Welding Fitting as shown by this trade mark... the right mark for every need in welding fittings and flanges.*

TUBE-TURN

TRADE MARK

Your nearby TUBE TURNS *distributor can serve you right from stock. Call him for prompt delivery.*

TUBE TURNS, INC., LOUISVILLE 1, KENTUCKY DISTRIBUTORS IN ALL PRINCIPAL CITIES

DISTRICT OFFICES: NEW YORK • PHILADELPHIA • PITTSBURGH • CHICAGO • HOUSTON • TULSA • SAN FRANCISCO • LOS ANGELES

What Other Drive Gives You...
1. HIGH STARTING TORQUE
Smooth... positive... powerful — that describes a Duplex Steam Engine starting under full load. No clutch — no gear shift — no torque converter... just steady, continuous, direct power as your load comes up to speed — as slow or as fast as you require.
Plus
2 UTMOST FLEXIBILITY
3 SIMPLICITY, LONG LIFE
4 ACCURATE, FAST SPEED CONTROL
5 BY-PRODUCT POWER

Up to speed without a falter: This 300 hp. Troy Duplex Steam Engine brings a positive displacement blower up to speed smoothly, dependably, without jolts or surges. The constant torque characteristic of the engine is also ideally suited to this load.

Which Do *You* Need?

If your drive needs any or all of these five characteristics, the *modern* Troy Steam Engine is indicated. Send us your drive requirements and steam conditions, and our engineers will be glad to recommend the right type and size Troy engine to meet your needs.

Send for Bulletin 306

TROY

Troy Engine & Machine Co.

Power Equipment Division

2503 RAILROAD AVENUE • TROY, PENNSYLVANIA

fine dust adheres to blades but there is no evidence of any impairment of performance.

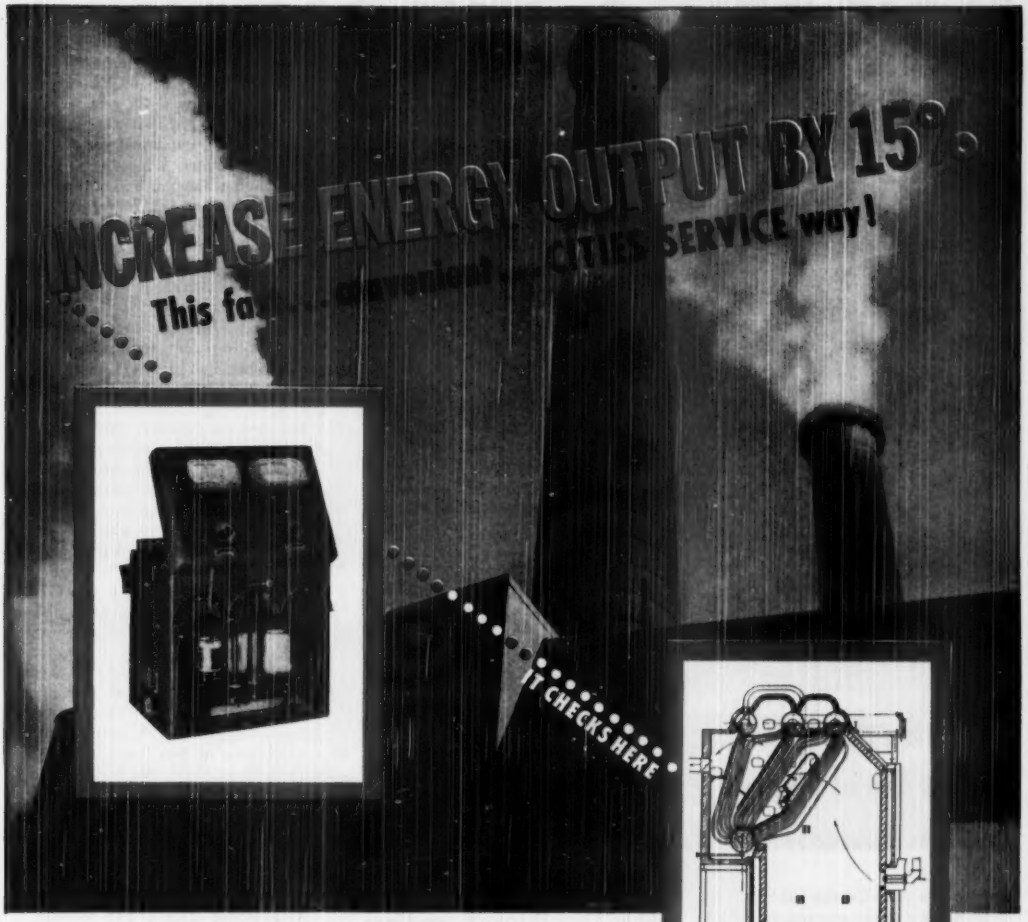
Next Step. The 4200-hp gas-turbine power plant built for the Committee by Allis Chalmers Mfg Co has undergone preliminary tests. It will soon be moved to Dunkirk for extensive stationary tests in an installation that will duplicate in every important particular the arrangement to be followed in the actual locomotive. If these tests are satisfactory, the power plant will be installed in a locomotive for extensive road testing.

Pilot-Plant Tests. Between the small-scale experimental work outlined in the box on page 82, and the full-scale program just described, there were pilot-plant and partial full-scale tests. In 1946, a pilot plant was installed at the Dunkirk N. Y. plant of Alco Products Division, American Locomotive Co. This could burn coal under pressure up to 60 psi and at rates up to 1000 lb per hr. A scaled-up version of the early setup at Johns Hopkins, this plant used a Standard Stoker piston pump to pressurize coal. A variable-speed screw fed coal from pressurized storage tank. A coal atomizer was used for pulverizing. Shop air at rates up to 1000 lb per min was available to burn coal, cool combustor and chill ash. A battery of small cyclone separators removed most of flyash before heated air was released through a reducing valve and a turbo-supercharger to gage effect of remaining ash on blades.

Pilot-plant operation revealed a number of major problems not discovered in small-scale testing at atmospheric pressure. Most serious was the fact that carbon remaining in ash burned vigorously in flyash separators. Carbon resulted from inability to reach more than 90% efficiency with a cold-walled combustor. This led to work on a ceramic-walled slagging combustor. In it, combustion efficiency consistently approached 98% and about half of ash appeared as slag in lumps of moderate size. Remaining flyash had a low enough carbon content to be harmless in separators.

Although the full-scale plant now being tested uses a later-developed cold-walled combustor, work continues on the ceramic type. A full-scale atmospheric-pressure horizontal unit is under way. For low-ash-fusion low-volatile coals, ceramic tubes show promise, but with all-metal combustor design now showing up well, this type will get the call for the first actual locomotive power plants.

Full-Scale Pressure Tests. Small-scale low-pressure tests showed need for working with full-scale equipment under gas-turbine conditions. This was undertaken in conjunction with Turbodyne Corp (a subsidiary of Northrop



The Cities Service Industrial Heat Prover

This remarkable instrument is an exhaust gas analyzer, designed for use on industrial furnaces regardless of size or type. It is provided with three scales; one shows per cent of oxygen, another percentage of combustibles present and measured in the flue gas sample, and the third scale registers flue gas temperature.

A fuel analysis taken at this important checking point—during a free demonstration—has led to increases in energy output as high as 15%. The Heat Prover indicates the type of adjustments necessary to get maximum combustion efficiency.

CITIES SERVICE

QUALITY PETROLEUM PRODUCTS

FREE—THIS HELPFUL BOOKLET

CITIES SERVICE OIL COMPANY
Sixty Wall Tower, Room 576
New York 5, N. Y.

Please send me without obligation your new booklet entitled, "Combustion Control for Industry."

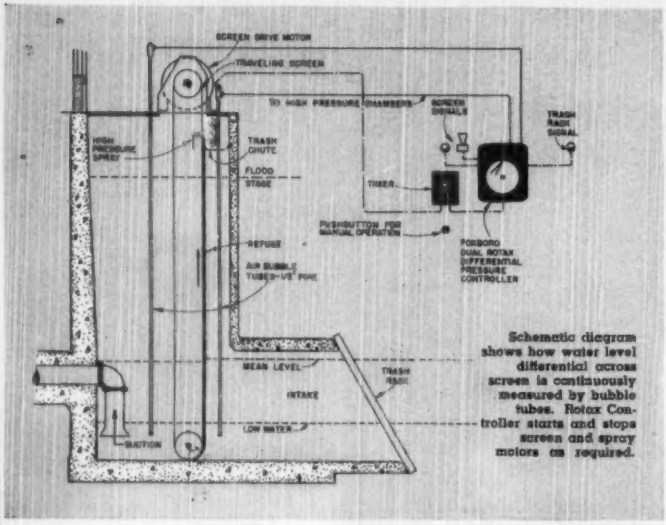
Name_____

Company_____

Address_____

City_____ State_____

Make traveling intake screens positively "Plug-Proof"



Schematic diagram shows how water level differential across screen is continuously measured by bubble tubes. Rotax Controller starts and stops screen and spray motors as required.

...with Foxboro liquid level type screen control

Make sure your intake suction well can't go dry when excessive refuse suddenly piles up on the traveling intake screen!

The Foxboro Traveling Screen Control System automatically starts the screen-rotating motor and the cleansing spray whenever refuse accumulation causes the water level difference between opposite sides of the screen to exceed a certain preset value. Quickly, it purges the screen of refuse and restores the intake level to normal —or sounds an alarm indicating that the cleaning mechanism is unable to cope with the difficulty. What's more, this action takes place only when the screen actually becomes clogged . . . no waste of power or unnecessary wear on mechanism through needless periodic operation.

The Foxboro Traveling Screen Control System is easy to install, inexpensive to operate, and pays big dividends in better intake operation, less maintenance and greater peace of mind. Write for complete information. **The Foxboro Company, 68 Neponset Avenue, Foxboro, Mass., U.S.A.**

ROTAX Liquid Level Controller. The heart of the system, translates level differential into operation of motors. In addition, it can operate warning horn or light in case of unusually severe fouling. Circular or rectangular case models.

FOXBORO INSTRUMENTATION
REG. U.S. PAT. OFF.

Aircraft, Inc) at the Kaiser Steel Mill, Fontana, Calif. Here, a spare steam-turbine-driven blast-furnace blower gave a firm supply of 100,000 cfm free air at pressures up to 25 psig.

During summer of 1947, coal-handling equipment of locomotive size was installed at Fontana. A locomotive stoker fed through a hammer mill and a slide-valve lock hopper to a large high-pressure tank. A variable-speed screw feeder was used in initial tests but many difficulties were met in attempting to control rate from a tank in which pressure varied. A belt feeder was substituted. System first operated under pressure in December 1947. In the months following it became evident that film-cooled metal combustors could be used with acceptable range, efficiency and life.

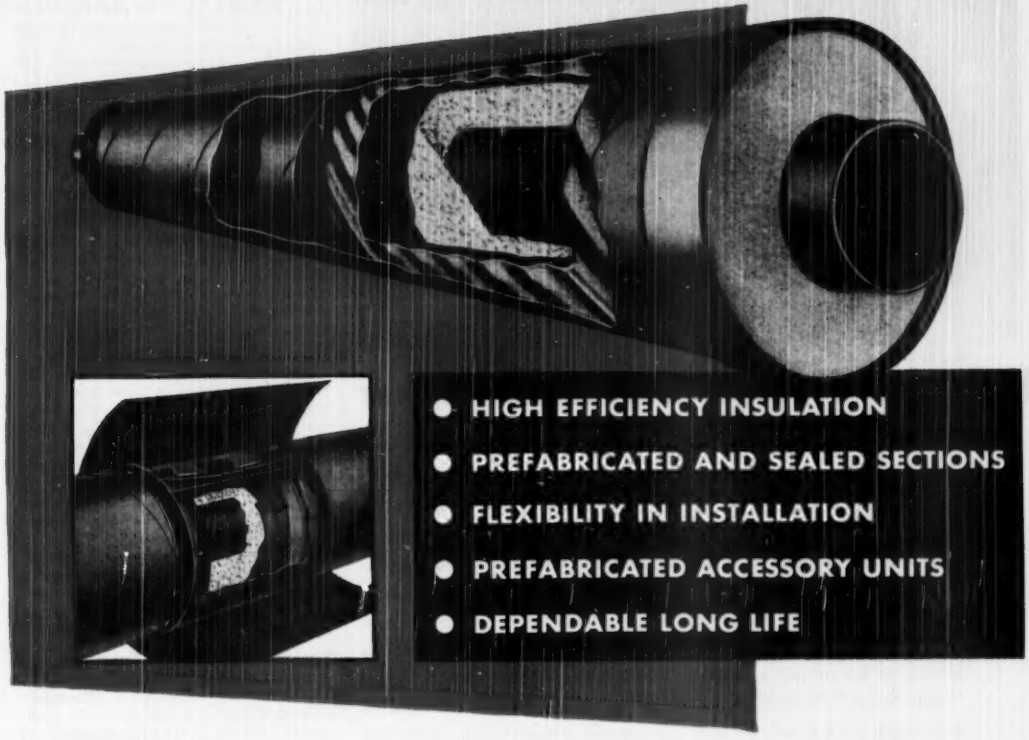
Pressurizing Problem. Feeding from a pressurized tank appeared impractical on a large scale. Thus attack was made on the problem of continuously pressurizing finely crushed coal. A rotary pump was developed, in which extremely close clearances were maintained by refined mechanical design. It was found that such a pump was practical for transferring coal from an atmospheric pressure source to a line at pressure up to 140 psi.

Ash Removal. Attention also turned to the ash-removal problem. Extremely wide range of particle sizes made 2-stage separation necessary. A louver separator was used as first stage, to concentrate large particles of ash into a small quantity of flowing air. This was then blown down to atmospheric pressure through an aspirating nozzle. Quenching of incandescent ash particles by aspirated cold air prevented burning of separator on this blowdown line.

As a second stage of ash removal, a battery of small cylindrical separator tubes of straight-through type was used. These caused most of dust to be removed from air by imparting vigorous spin to air and dust and drawing off concentrated solid particles in a small secondary stream of air. Again, the continuous blowdown method was used to dispose of this dust. Extensive tests indicated that few particles larger than 20 microns were getting through this system and most of these appeared to be agglomerates rather than individual particles. By early spring of 1949 it was concluded that combustion and ash-removal systems were developed to a point where it would be safe to operate a full-size experimental turbine. The previously described work on the Houdry unit was then begun.

Laclede Christy has entered into an agreement to acquire assets and liabilities of Chicago Retort and Fire Brick Co, Ottawa, Ill.

ONLY RIC-WIL GIVES YOU ALL THESE ADVANTAGES



- HIGH EFFICIENCY INSULATION
- PREFABRICATED AND SEALED SECTIONS
- FLEXIBILITY IN INSTALLATION
- PREFABRICATED ACCESSORY UNITS
- DEPENDABLE LONG LIFE

When planning your next job, specify Ric-Wil Prefabricated Insulated Piping and take advantage of these features that lower installation, operating and maintenance costs.

Prefabricated to fit your specific piping system planning, they are constructed with "built-in" endurance and high efficiency insulation. In addition, Ric-Wil Engineering service is available for planning and field installation assistance.

Forty years of designing, engineering and production experience insures reliable and lasting operation of Ric-Wil Piping Systems.

Upon request, our representative will provide detailed Ric-Wil technical information as related to your specific problems.

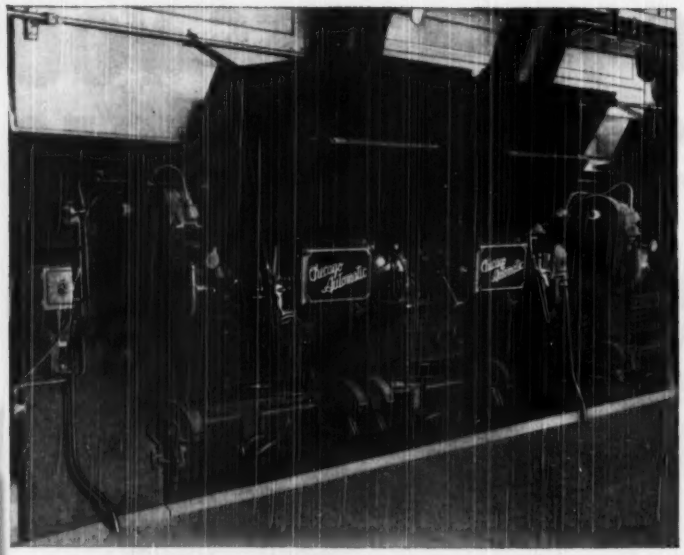
For full technical information on Ric-wiL Insulated Piping Systems, call or write the Ric-wiL office nearest you or Dept. 5-F in Cleveland, Ohio.

RIC-WIL

INSULATED PIPING SYSTEMS

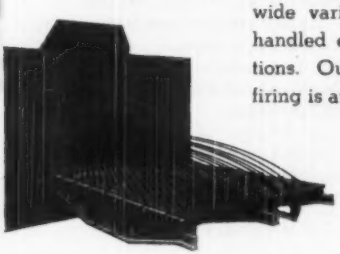
OVERHEAD — THE RIC-WIL COMPANY · CLEVELAND, O. — UNDERGROUND

FOR FORTY YEARS THE GREATEST NAME IN INSULATED PIPING SYSTEMS



How the Chicago Automatic Stoker Provides Uniform Lateral ~ ~ And Longitudinal Firing

COAL distribution with this dependable spreader stoker is controlled by an adjustable firing plate in conjunction with a series of rotating distributing blades carefully selected for a definite grate area and specific draft conditions. After these blades are performance-set for proper angularity and spacing, coal is spread by the "underthrow" principle to reach all sections of the grates according to a fixed pattern. Spreader stoker firing—with the Chicago Automatic is economical firing—a wide variety of the cheaper coals can be handled efficiently regardless of load conditions. Our long experience on spreader stoker firing is at your service.



Write for recommendations

THE STANDARD STOKER CO., INC.
DEPT. D7, 370 LEXINGTON AVENUE
NEW YORK 17, NEW YORK

THE STANDARD STOKER CO • INC •

Standard Stoker 566

NEW YORK • CHICAGO • ERIE • MONTREAL

(*Continued from page 192*)

plus detail on editorial style. The book is summed up by a table of do's and don'ts.

HANDBOOK OF RIGGING, *by W E Rossnagel, safety engineer, Consolidated Edison Co of N.Y., Inc,* 321 *pp,* 6x9, *illust, cloth,* $4.75. *McGraw-Hill Book Co, Inc,* 330 *W* 42*nd St, New York* 18, *N. Y.*

Intended for the professional rigger, this book is a handy guide for power engineers and maintenance mechanics as well as crane operators and painters.

The language is nontechnical, with simple equations and sample problems to find the strength of hoisting tackle, beams and posts for supporting loads. In some special cases detailed shop drawings are included.

Enough technical data are included to make the book valuable to design and construction engineers, plant superintendents, inspectors and safety engineers.

WELDING AND CUTTING FUMES, AND HEALTH AND THE WELDER, *by Clyde B Clason and Phil Glanzer,* 16 *pp,* 8½x11, *illust, paper,* 25c. *Reprinted from "Welding Engineer" and available from Lincoln Electric Co, Cleveland* 1, *Ohio.*

Welding and Cutting Fumes attempts to answer the question of what, if any, diseases can be traced to fumes created by welding and cutting. The author reveals that an extensive review of current medical literature shows under normal conditions welding fumes (1) are not a cause of pneumonia (2) do not result in silicosis (3) do not create a tendency to tuberculosis, and cannot be blamed for other ailments commonly attributed to them.

Phil Glanzer in *Health and the Welder* reviews the fume problem in conjunction with other health hazards in welding. Table of minimum air requirements per person is given along with ventilating methods.

STANDARD METHOD AND PROCEDURE FOR DETERMINATION OF DISSOLVED OXYGEN, IN DEAERATED AND PARTIALLY DEAERATED WATERS, 8½x11, 32 *pp, paper.* $2. *Published by Heat Exchange Institute,* 90 *West St, New York* 6, N. Y.

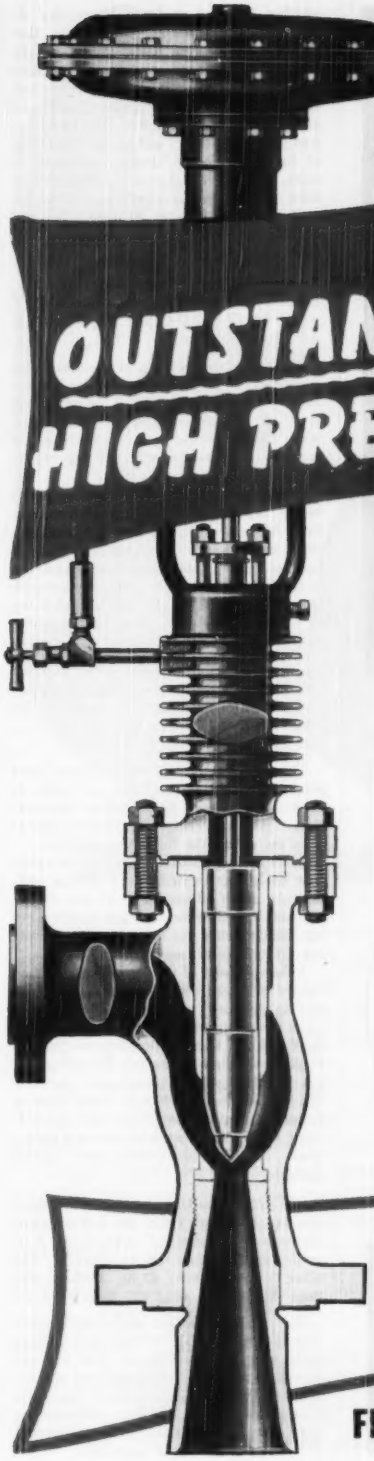
Standards have been selected from the results of a comprehensive investigation of the various test methods and procedures commonly used. Method and procedure described produce accurate and reliable test results, even for the analysis of waters containing reasonable quantities of impurities.

Apparatus recommended, method of sample collection, procedures for fixing and titrating samples, as well as the computation of results, are described and illustrated. Accuracy and limitations of the test method and procedure are carefully explained, and a comprehensive method of determining the significance of test results is disclosed.

GAGING PRACTICE FOR BALL AND ROLLER BEARINGS, *B3.4*—1950. 12 *pp,* 8½x11 *in.,* 15 *illus.,* 4 *tables, paper,* 50c. *American Standards Assn,* 70 *E. 45th St, New York* 17.

This American Standard is the first of a series under development by a committee representing 14 engineering associations of industrial users and manufacturers of bearings and the U.S. Army and Navy. The most acceptable methods of determining

FISHER offers an OUTSTANDING VALVE for HIGH PRESSURE CONTROL



FOR

CONDENSATE CONTROL IN HIGH PRESSURE POWER PLANT INSTALLATIONS WHERE VALVE HANDLES FLASHING CONDENSATE BETWEEN HEATER STAGES

Popular Sweep-Flo angle body with designed contours to avoid abrupt changes in flow direction. Embodies use of venturi throat recovery nozzle which offers two outstanding advantages.

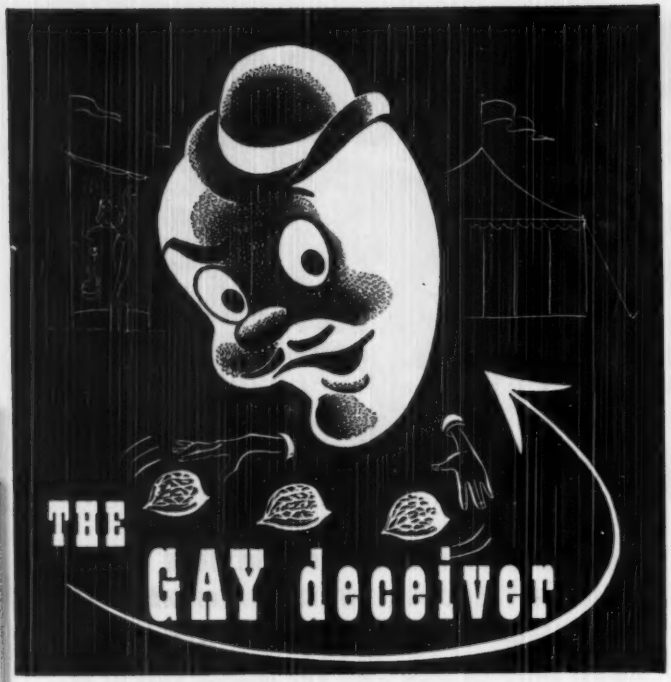
1. Reduction of noise as encountered in condensate flashing—reducing cavitation with its high level noise nuisance. Recovery throat allows gradual reduction of velocity as sectional area increases to full diameter in venturi throat fashion.

2. Enables flash conditions to take place downstream from valve—or in heater—or in evaporator. Eliminates washing out of valve, fittings and line, as is quite regularly encountered where condensate handled has low oxygen concentration.

WRITE TODAY FOR FURTHER DETAILS

Sectional View of
VENTURI THROAT RECOVERY NOZZLE
Throat extension acts as retainer for valve seat ring. Welded in place to prevent loosening under vibrating conditions.

FISHER GOVERNOR CO., Marshalltown, Iowa



Don't be fooled by power-laden Btu's that escape from improperly insulated or uninsulated heated equipment. Such shenanigans represent an expensive luxury which no plant can afford.

Check power losses, cut production costs, raise efficiency. Be sure your heated equipment is protected by efficient, low-cost **CAREY Industrial Insulation!**

And here's a new product to keep Btu's on the job . . . **CAREY TEMPCHEK**

a specialized material with a temperature range up to 1500° F., low K factor, rugged strength, excellent "Handle-ability"—

it's a combination of outstanding qualities . . . ***Ask about it!***

Call your CAREY representative today. He's a trained expert who is eager to serve you.

CAREY Makes the Complete Line!

85% Magnesia—Industrial Rock Wool—Asbestos—Pipe Coverings—Sheets—Blocks—Batts—Papers—Air-Cell.

Write for your free copy of "Heat Insulation For Industry." Address your request to Dept. PO-5, The Philip Carey Manufacturing Company, Cincinnati 15, Ohio. In Canada: The Philip Carey Company, Ltd., 1567 MacKay Street, Montreal 25, P. Q.

A PRODUCT OF THE HOUSE OF **Carey**

whether bearings conform to specified dimensions are specified. Means are thus provided for bearing users, manufacturers, engineers, inspectors and shop personnel to "talk the same language." Inspection methods are defined, giving loads and methods of measurement. Included are standard methods for obtaining dimensions of inner and outer rings, parallelism of sides, eccentricity, groove parallelism with sides and other measurements. Also prescribed are methods of measuring internal fits and tolerances for side run-out of locknuts.

TECHNIQUES OF PLANT MAINTENANCE, *Parts 1 and 2. About 400 pp, 8½x11, paper.* $2. *Clapp & Poliak Inc, 341 Madison Ave, New York 17, N.Y.*

Consists of proceedings of the first plant-maintenance conference in Cleveland, Ohio, January 16-19, 1950. Vol I contains the texts of prepared papers and addresses, while Vol II is made up of questions and answers in connection with the papers presented.

These books are of value to all in a supervisory capacity in the plant-maintenance field. Matters of organization and management, maintenance costs, selection of lighting equipment, maintaining motors and controls, plant housekeeping, etc, are covered. Questions and answers in Vol II touch many of the problems plant men are wrestling with at present.

AN INTRODUCTION TO THE GAS TURBINE (1949) *By D G Shepherd, asst professor, Cornell University. 387 pp, 8¾x5¾, 174 illust, cloth.* $5. *D Van Nostrand Co, Inc, 250 Fourth Ave, New York, N.Y.*

Though this book is for engineers with some technical background in gas turbines, each topic is introduced with an explanation of the underlying fundamentals. Initial chapters define the basic physical and engineering concepts of the gas-turbine cycle. The book then describes the various components and outlines some of the design methods. Applications of gas turbines to constant-pressure cycles as a prime mover are the only ones considered.

Although most of the design information relates to aircraft applications this can be readily adapted to other industrial uses since the difference is one of degree rather than of kind. Chapter headings outline the book, basic thermodynamics, flow of gases, gas-turbine cycles, compressor, turbine, combustion, heat exchange, some existing power plants, developments and applications, experimental methods and test equipment, auxiliary equipment and control methods.

THE THEORY AND DESIGN OF GAS TURBINES AND JET ENGINES (1950) *By E T Vincent, professor of mechanical engineering, University of Michigan. 606 pp, 6¼x9¼, 283 illust, charts, cloth.* $7.50. *McGraw-Hill Book Co, 330 W 42nd St, New York 18.*

The aim is to enable senior undergraduate and graduate students to solve average gas-turbine design problems. The text endeavors to bring aerodynamic and gas dynamic problems down to a point where the general engineering student without an aeronautical background can understand

(*Continued on page 212*)

*UNIFORMITY

Under all conditions the proved performance of Tycol lubricants more than meets their recommended service.

Rigidly controlled and tested during manufacture . . . and refined from the highest grade crudes, Tycol oils and greases are known for their *UNIFORMITY within each classification — from the first drum to the last.

This unvarying high quality, plus the scope of the line, accounts for Tycol's wide acceptance by industry interested in maximum production . . . top efficiency . . . lowest operating cost.

Whatever your lubrication need, let a Tide Water Associated engineer help you select the one suited for your particular need. Call, write or wire your nearest Tide Water Associated office for full details.

TYCOL
INDUSTRIAL LUBRICANTS

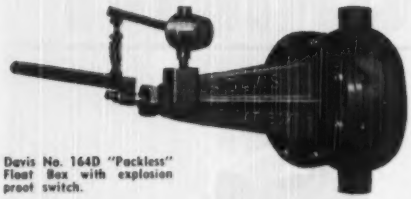
Boston • Charlotte, N. C. • Pittsburgh • Philadelphia • Chicago Detroit • Tulsa • Cleveland San Francisco • Toronto, Canada

TIDE WATER ASSOCIATED OIL COMPANY
17 BATTERY PLACE · NEW YORK 4, N. Y.

*LEARN WHAT THIS PRODUCT CHARACTERISTIC MEANS TO YOU — READ "LUBRICANIA"
This informative handbook, "Tide Water Associated Lubricania," gives clear, concise descriptions of the basic tests used to determine important properties of oils and greases. For your free copy, write to Tide Water Associated Oil Company, 17 Battery Place, New York 4, N. Y.

REFINERS AND MARKETERS OF VEEDOL — THE WORLD'S MOST FAMOUS MOTOR OIL

DAVIS FLOAT BOXES



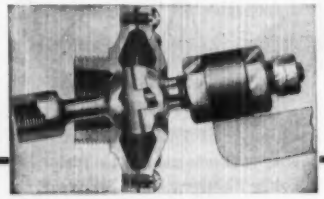
Davis No. 164D "Packless" Float Box with explosion proof switch.

FOR LIQUID LEVEL CONTROL SERVICE

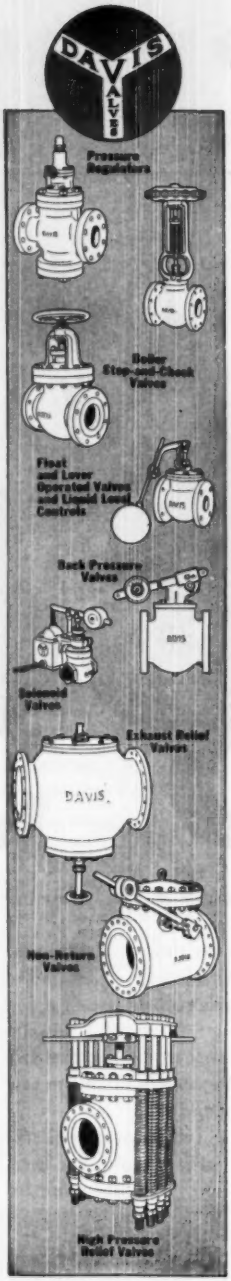
DAVIS Float Boxes are used in connection with closed tanks where fluctuation of the fluid level within the tank is the governing factor in the control of all types of electrical switches, control valves, pilot valves (for operation of diaphragm motor valves), motors and other equipment. Davis fluid control equipment also includes internal float units for direct or pilot operation. Whatever your requirement may be, Davis can supply you with a combination of float box and control valve to make your control accurate, positive, and dependable.

Drop us a card today for detailed information on the Davis line. Ask for Bulletin 101AA.

DAVIS DIA-BALL TRANSMISSION UNIT



A patented, leakproof, corrosion resistant packless assembly eliminating the packing box on Davis Float Boxes and Control Valves. Especially recommended for vacuum service or for use with volatile and inflammable fluids where a packing box is objectionable because of leakage. For pressures up to 250 lbs. and temperature up to 300° F.



DAVIS REGULATOR CO.

Representatives in All Principal Cities

2540 S. WASHTENAW AVENUE, CHICAGO 8, ILLINOIS

POWER NEWS

Power Increase From Niagara Falls

Washington diplomats have opened the way for redevelopment of the power of Niagara Falls. A new Niagara River water treaty, revising a 41-year-old one, was signed by Secretary of State Dean Acheson and Canadian Ambassador Hume Wrong. When both nations ratify the new treaty, vast new power may be taken from the honeymooners' falls.

Power possibilities, which set off the negotiations for the new treaty, are described in a Federal Power Commission report, March, POWER, p 116. It proposes a $300 million-plus redevelopment in the U.S., promising more than three times the power now produced from the Falls. Terms of the new treaty reallocate water between the two nations, calling for a 50-50 sharing of that available for power use. The earlier treaty had given Canada a larger share.

Despite the important role of power in the new treaty, it provides for an adequate flow over the falls to preserve the scenic spectacle. From April 1 to Sept 15 each year, flow over the falls will be maintained at not less than 100,000 cu ft per sec from 8 am to 9 pm. From Sept 12 through Oct 31, the required flow during these hours need be only 50,000 cu ft per sec, but this may be increased for flushing ice. In addition, the treaty provides for the construction of remedial works to insure an unbroken crestline at the falls.

New Officers at McGraw-Hill Pub Co

McGraw-Hill Publishing Co has announced the resignation of James H McGraw Jr, as president and chairman of the publishing firm and from all other offices in McGraw-Hill subsidiaries. Curtis W McGraw succeeds him as president and chairman; Willard Chevalier takes over the newly created post of executive vice-president; and Joseph A Gerardi becomes treasurer to succeed Curtis W McGraw.

Boiler Tragedy At New York Steam

On March 27, 1950 the Kips Bay Station of the New York Steam Corporation, New York, N. Y. was the scene of a tragic coincidence that took the lives of four men. The men were calibrating a flowmeter located about 20 ft from the ashpit of No. 5 boiler, steaming at 750,000 lb per hr with a pressure of 265 psig. Without warning a screen tube ruptured just above the mud drum, forcing open the ashpit doors. The boiler-room cellar ordinarily unoccupied was filled with steam and superheated water flashing into steam. It was a half hour before the scalded bodies of the victims were removed.

Ohio Society of Stationary Engineers and Boiler Operators, chartered in the State of Ohio, has organized for the purpose of advancing and improving the Ohio State license law governing engineers.

(*Additional news on page* 138)

No Other Water Conditioning System Has All of These Features...

...ALL IN ONE TANK:

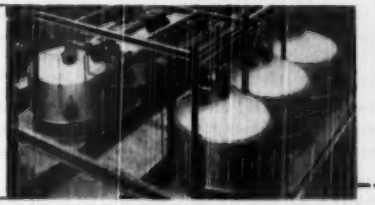
YES, you get all these and more, too, in one tank without the aid of internal mechanical agitation or other moving parts when a water conditioner like this 900,000 lb. per hour Worthington installation treats your make-up or condensate water.

In less space you get all the heating, chemical feeding and clarification facilities to provide optimum water conditioning results. Worthington's engineering skill and complete manufacturing facilities offer you the advantages which can only result from carefully coordinated effort under one responsibility.

WRITE FOR FACTS

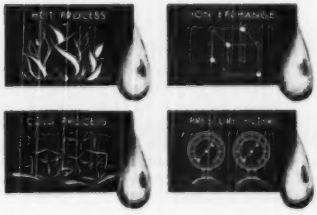
For proof that, in water conditioning as in so many other services, *there's more worth in Worthington*, write for Bulletin W-212-B2. *Worthington Pump and Machinery Corporation, Water Treating Division, Harrison, N. J.*

Main treating tank of a Worthington Hot Process Water Conditioning System, capacity 900,000 lb. of treated water per hour



Six pressure filters 11 feet in diameter used for final clarification in this Worthington Hot Process Water Conditioning System

JB-3

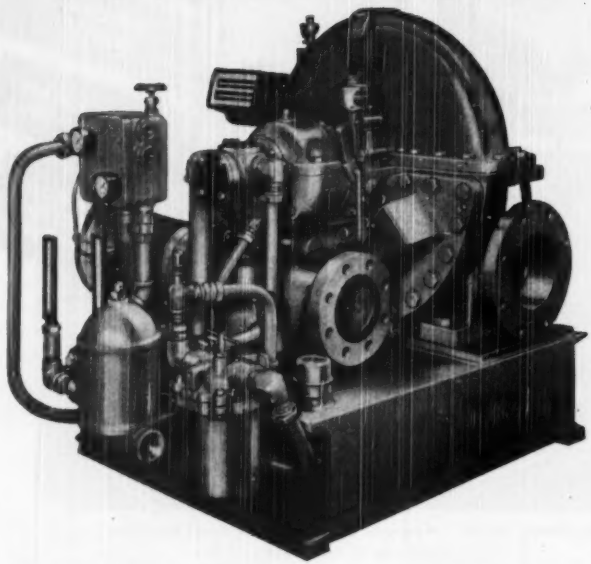


WORTHINGTON

WATER CONDITIONING

Worthington Makes More *of the Equipment For All Types of Water Conditioning Systems*

MURRAY
TYPE S
VARIABLE SPEED
TURBINE



Murray Type S Steam Turbines are well suited to a variety of jobs including those drives requiring variable speed. These turbines may be constructed with hydraulic type variable speed governors and complete pressure lubrication system including reservoir, filter, cooler, oil pressure gauges and thermometers.

Turbines so equipped are not only suitable for variable speed operation but for higher operating speeds as well. These features make the Type S variable speed turbine an ideal drive for high speed centrifugal compressors and blowers.

Pictured above is such a machine designed to deliver 400 HP at 7400 RPM. This machine is arranged for speed adjustment by means of hand control or by automatic control. The turbine is also equipped with a vibrating type speed indicator and a remote control tripout device. Note that the construction provides an oil tank of generous oil capacity. The combined base and tank arrangement may be extended for mounting the driven machine if desired.

Write today for full details

MURRAY IRON WORKS COMPANY
BURLINGTON, IOWA

BUILDERS OF STEAM POWER EQUIPMENT FOR THREE QUARTERS OF A CENTURY

(*Continued from page 208*)

the main problem involved. The text presents thermodynamic principles forming the basis of gas-turbine operation, fundamentals of gas flow, jet propulsion with a description of each form of prime mover. Its chapters include an extended treatment of all gas-turbine plant components as well as the various forms of basic heat-power cycles. One chapter deals with materials for gas turbines with emphasis on high-temperature needs.

REFRACTORIES *third edition*—(1949) *By F H Norton, professor of ceramics, Mass. Institute of Technology.* 782 *pp,* 6½x9¼ 419 *illust,* 163 *tables, cloth.* $8.50. *McGraw-Hill Book Co.,* 330 *W* 42*nd St, New York* 18, *N. Y.*

This well-known text is completely rewritten to include new material emanating from wartime advances. These include sections on molding, plasticity, raw materials, firing, refractories for steel manufacture and refractories for steam boilers. New material includes nonplastic casting, hydrostatic molding, hot pressing, laboratory furnaces, properties of pure refractory materials, refractories for nuclear power and jet propulsion.

While this book may be of prime interest to the refractory manufacturing industry, boiler designers and operators faced with selecting refractories will find here a wealth of information on the characteristics of these materials.

HEAT PUMP APPLICATIONS, *by Emory N Kemler, assoc director, Southwest Research Institute, and Sabert Oglesby, Jr, instructor in electrical engrg, Purdue University.* 300 *pp,* 6x9, *illust, cloth.* $6. *McGraw-Hill Book Co,* 330 *W* 42*nd St, New York* 18, *N.Y.*

A good book to bring you up to date on the heat pump, now attracting attention here and abroad. Right at the beginning—in the first four chapters—you'll find an outline of what the heat pump is and what it offers, plus a comprehensive roundup of present commercial, industrial and residential applications. With this introduction you're ready to tackle the thermodynamics of refrigeration and refrigerants, and the various types of heat-pump hookups. Then the authors take you, step by step, through the essential elements of a heat-pump system: heat sources, compressors, fans and ducts, motors, heat exchangers, accessories and storage systems. They wind up with a discussion of temperature and design data and a summary of heat-pump patents.

AN INDEX OF NOMOGRAMS (1950) *By Douglas P Adams, associate professor of graphics, Mass. Institute of Technology.* 174 *pp,* 7½x9¾, *tables, cloth.* $4. *Published jointly by Technology Press of MIT and John Wiley & Sons, Inc,* 440 *Fourth Ave, New York* 16, *N.Y.*

This book gives references to about 1700 alignment diagrams published in various technical journals and periodicals. Nomograms are first indexed by name of subject, which covers practically the entire engineering field. This index refers to a second listing giving name of periodical and the issue and page number on which the nomogram appeared.

Good Horse Sense . . . to Use These HEAVY-DUTY CLARAGE FANS

TYPE CI EXHAUSTERS

Capacities to 4000 CFM; Pressures to 20"

Nothing shoddy or flimsy about these smaller Clarage industrial fans. They are O.K. for continuous service — built to the *same exacting standards* as the largest Clarage equipment.

Try them! . . . then you will readily understand why we call them "HEAVY-DUTY" — *and mean just that!*

Use Clarage Type CI Exhausters for removing excess heat, dust, smoke, odors from any manufacturing operation — for supplying air to oil burners, as over-fire fans, etc. Use them for pneumatic conveying.

Fans also can be furnished gas tight, rubber covered, or with vulnerable parts of stainless steel or Monel — in fact, *in any construction* your special needs demand.

Standard fan housings and side plates are cast iron, long wearing, long resisting to corrosion. Heavy steel plate wheels are perfectly balanced. Fans in each of the 6 sizes can be V-belt or direct motor driven.

TYPE O BLOWERS

Capacities to 30,000 CFM; Pressures to 35"

Another Clarage HEAVY-DUTY industrial fan! Use Type O Blowers for *high pressure* applications — supplying air to cupolas, gas and oil burners, etc. Fan housings and wheels are heavy steel plate equal to severest conditions. Built in 19 sizes, operating at speeds *most economical* for direct motor or steam turbine drive.

WE ALSO MAKE:

LARGE INDUSTRIAL FANS
AIR CONDITIONING EQUIPMENT
AIR WASHERS UNIT HEATERS

CLARAGE FAN COMPANY – *Kalamazoo, Michigan*

CLARAGE

—HEADQUARTERS for Air Handling and Conditioning Equipment

SEE OUR CATALOG IN SWEET'S

It pays to direct fan inquiries our way . . . phone Clarage office in your city, or write us at Kalamazoo.

Application Engineering Offices in All Principal Cities

Wherever an Air CLEAN-UP is Required . . .

Clarage Capillary Conditioners Guarantee a Thorough Job!

Here are units that "wrap in a single package" the answers to (1) **maximum air cleanliness,** (2) **accurate temperature control,** (3) **close humidity regulation.**

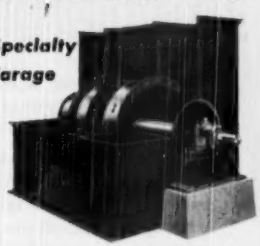
A Clarage Air Conditioner of this type includes a capillary cleaning section, pump, heating coils, fans, drive, and motor. Completely assembled — as either vertical or horizontal units — they install quickly and inexpensively. No additional parts or costly building alterations required. Seven sizes available — delivering from 1,800 to 20,000 cubic feet of air per minute.

Yes, where **thoroughly conditioned air** is vital to production, uniformity of product, health, or safety, there are many good reasons for choosing this modern equipment. Dependable performance is promised by scientific factory testing; **low first and operating costs** assured by Clarage's advanced engineering.

★ ★ ★

MECHANICAL DRAFT FANS

. . . a Specialty with Clarage



Recognized champions in the heavyweight class are these Clarage Fans for induced and forced draft service.

In thousands of central stations and industrial power plants Type RT Fans have proved — **and annually continue to prove** — their ability to withstand severest operating conditions. Shaft and bearings are EXTRA large; wheels EXTRA heavy; all points of stress HEAVILY reinforced!

Whenever air must be handled at high temperatures, high pressures, OR BOTH — for many industrial processes as well as in mechanical draft service — Type RT fans write outstanding performance records.

CLARAGE FAN COMPANY, Kalamazoo, Mich.

ADD THIS

No instrumentation is really complete unless an automatic coal scale is an integral part of it. Only then can you have a minute-by-minute record of every pound of coal consumed per boiler.

RICHARDSON AUTOMATIC COAL SCALES give you this fully accurate record, automatically—hour by hour, shift by shift, week by week. Result: you spot instantly any coal-wasting boiler or other operating inefficiency... *keep power production costs at the minimum, power production itself at the peak.*

Coal is your biggest single item of expense. Be sure you're getting full capacity in b.t.u. and kw.-hr. from every boiler or turbine in your plant. Get all the facts on the economy, dependability and proven efficiency of RICHARDSON AUTOMATIC COAL SCALES. Write today for Bulletin 1143. It shows you how you can take a long step forward toward minimum coal costs... maximum power production.

RICHARDSON SCALE COMPANY
CLIFTON, N. J.
Atlanta • Boston • Buffalo
Chicago • Omaha • New York
Pittsburgh • San Francisco
Philadelphia • Minneapolis
Wichita • Montreal • Toronto

6310

APPOINTMENTS

General Electric Co names G F Maughmer manager of newly established Apparatus Dept sales district in the Midwest. The district consists of all sales areas presently in the company's St. Louis, Kansas City and Omaha territories and will have its headquarters in St. Louis. In transformer and allied products divs, Pittsfield, Mass., Max I Alimansky is promoted to assistant manager of engineering. Also, James Hollands Alderman becomes district representative for Construction Materials Dept in North Central district with home office at 110 N Illinois St, Indianapolis, Ind. Robert O Bullard is appointed assistant business and construction manager of the Knolls Atomic Power Laboratory.

Coast Equipment Co, San Francisco, Calif., 948 Bryant St, has been chosen by **Joy Mfg Co** as northern California sales and service representative.

Fluor Corp, Ltd, announces the following personnel promotions: James G DeFlon, is assigned to New York sales office; Lee Weidlien rejoins the firm to take charge of sales in San Francisco office; and Jack E McKay is advanced to position of sales engineer in Houston sales office.

Harry G Smith has been named vice-president and director of sales for **Ohio Injector Co,** Wadsworth, Ohio.

L J Wing Mfg Co consolidates its general offices from New York City and three separate factories from Newark, N. J., in a single modern building at Vreeland Mills Rd, Linden, N. J. An office at 154 W 14th St, New York City, will be maintained to handle sales in that area.

William E Clark has been elected a member of the executive committee of **Dravo Corp,** Pittsburgh, Pa., and has also been appointed general manager of engineering works division.

Allis-Chalmers, Milwaukee, Wis., names Chester W Schweers to succeed W F Taylor, resigned, as manager of its New England region with headquarters in Boston. Alfred E Kilgour becomes assistant engineer-in-charge of circuit breaker sales succeeding William G Lewis. Lewis is now assistant to L W Long, general manager of Boston works.

C B Marshall Jr has joined sales force of **Babcock & Wilcox Tube Co's** Chicago district sales office. His headquarters are at 105 S LaSalle St.

Chase Brass & Copper Inc promotes Melvin C Harris to works manager of its Cleveland, Ohio mills. Harris replaces William F Aylard who is now chief engineer of the company.

E K Wolfram, 810 N Milwaukee St, Milwaukee, Wis., will represent **Fairfield Engrg Co** in eastern Wisconsin territory.

Samuel G Allen is elected chairman of the board of **Combustion Engrg—Superheater Inc** succeeding the late Frederic A

D. A.*

An HONORARY DEGREE Conferred on

MIDWEST WELDING ELBOWS

By Pipe Welders Everywhere

Pipe welders who know Midwest Welding Elbows have conferred upon them an honorary degree unique in piping . . . "D. A." for "dimensional accuracy".

This degree was earned for Midwest Elbows by their unique process of manufacture. In this process, developed by Midwest, the elbow is first made slightly oversize. After welding it is reheated to forging temperature and brought to final size in compression dies. This relieves forming and welding stress . . . assures true circular cross-section, controlled wall thickness and accurate radius, included arc and tangents. The elbows are beveled on special machines which cut both ends simultaneously, holding exact included angle and center-to-end dimensions.

"D. A." is a degree which means a lot to pipe welders. It means that they don't have to waste time lining up inaccurate fittings. It means that they don't have to spend time and weld metal in compensating for bad fit. And it means that they can produce better, cleaner, stronger welds with less trouble.

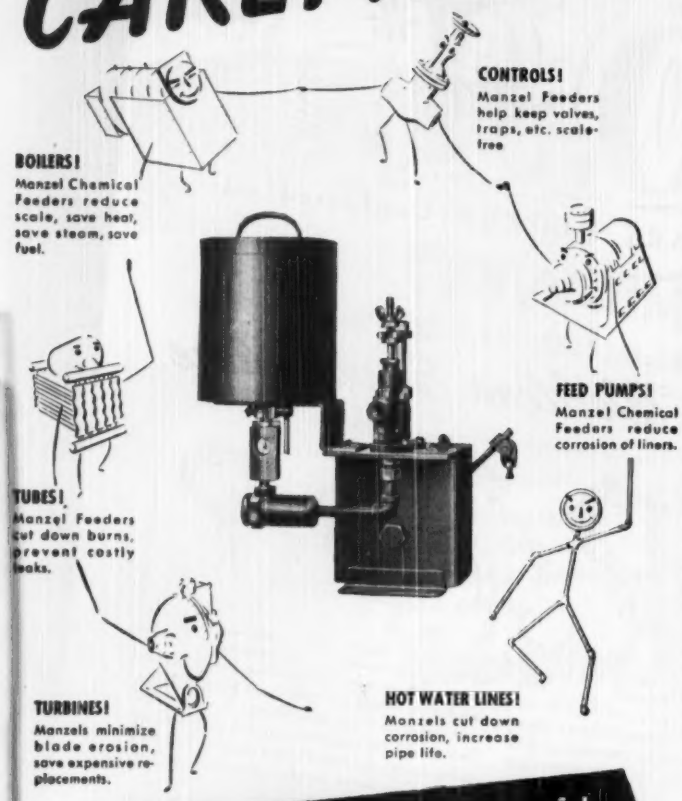
"D. A." saves money for you when it saves time and trouble for welders. Use Midwest "D. A." Elbows on your next job. Call your Midwest Distributor; there is one conveniently near you.

MIDWEST PIPING & SUPPLY CO., Inc.
MAIN OFFICES: 1450 SO. SECOND STREET, ST. LOUIS 4, MO.
Sales Offices: New York 7—30 Church St. • Chicago 3—79 W. Monroe St. • Los Angeles 33—520 Anderson St. Houston 2—1213 Capitol Ave. • Tulsa 3—533 Mayo Bldg. Boston 27—426 First St. • Stocking Distributors in All Principal Cities

* Dimensional Accuracy

MIDWEST WELDING FITTINGS IMPROVE DESIGN AND REDUCE COSTS

CAREFREE!


CONTROLS!
Manzel Feeders help keep valves, traps, etc. scale-free
BOILERS!
Manzel Chemical Feeders reduce scale, save heat, save steam, save fuel.
FEED PUMPS!
Manzel Chemical Feeders reduce corrosion of liners.
TUBES!
Manzel Feeders cut down burns, prevent costly leaks.
TURBINES!
Manzels minimize blade erosion, save expensive replacements.
HOT WATER LINES!
Manzels cut down corrosion, increase pipe life.

Smart Power Engineers Use Manzel Chemical Feeders to Keep Water Correctly Treated... Automatically

● Whatever chemicals are recommended by corrosion experts, there is a Manzel Feeder to inject them automatically into your water lines in the exact proportion needed.

Manzel Chemical Feeders are available for operation from reciprocating drive, from rotary drive, from electric motor drive, and from gas or air pressure. They have been famous for many years for dependability, accuracy and economy. You, too, can reduce replacement and fuel costs, prevent breakdowns, insure profitable operation. Call your nearest Manzel representative or write...

Manzel Inc. now supplies repair parts for all models of Bowser and Torrington Lubricators.

Builders of HIGH PRESSURE METERING PUMPS Since 1898

Manzel INC.

326 Babcock St.
Buffalo 10, N. Y.

Schaff. In addition, Joseph V Santry, president, will also serve as chief executive officer in general charge of operations.

Kinney Mfg Co has moved its Chicago branch office to new quarters at 122 S Michigan Ave. Office continues in charge of Alfred J Munday.

Plibrico Jointless Firebrick Co announces appointment of Robert P Ranahan as manager of Plibrico Sales & Service Co, P O Box 1306, Springfield, Mass. Ranahan replaces Julius L Gottsche, retired.

Gen Brehon Somervell has been elected chairman of **Koppers Co,** Pittsburgh, board of directors following retirement of J P Williams Jr. Williams will remain a member of the board. W F Munnikhuysen has been made executive vice-president. Also, membership of the board of directors has been increased from 9 to 11 to include two new members: Munnikhuysen and Joseph Becker, vice-president and general manager of the firm's engineering and construction div. Other members have been re-elected.

Quaker Rubber Corp, now a division of H K Porter Co, opens a new stock carrying branch at 311 First Ave, Pittsburgh, Pa. H M Sossaman is in charge serving customers in western Pennsylvania, eastern Ohio and West Virginia.

John M Stevenson joins **Youngstown Sheet & Tube Co** as development engineer in its mill research and development dept. He will be in the company's Tulsa, Okla. office for the present.

Link-Belt Co announces election of David E Davidson as vice-president of sales, with headquarters at the company's executive offices, 307 N Michigan Ave, Chicago. Eugene P Berg succeeds Davidson as general manager of Pershing Rd plant, Chicago.

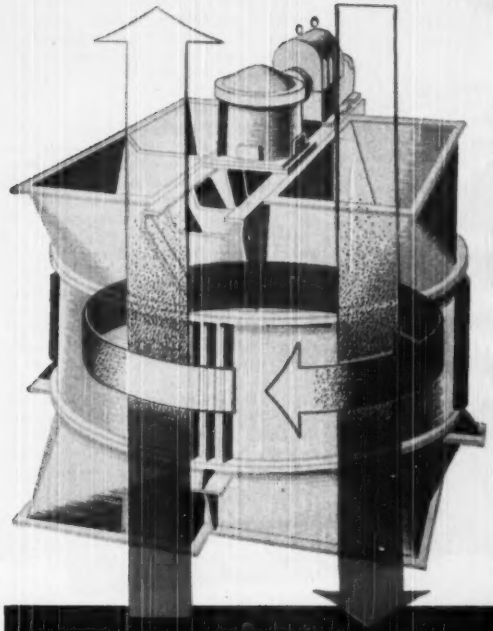
John B Moxness has been named industry engineer in charge of sales promotion of control devices for **Brown Instruments Div,** Minneapolis-Honeywell Regulator Co, Philadelphia.

Allegheny Ludlum Steel Corp assigns Roy D Haworth Jr to its Carbide Alloys Div as manager of product development. Haworth will be at the division's headquarters and plant in Ferndale (Detroit), Mich.

Machinery & Equipment Sales Inc, 1014 Cathedral St, Baltimore, Md, is chosen by **R P Adams Co** as its exclusive representative in Maryland.

O S Dollison is elected vice-president of **Lee Rubber and Tire Corp,** with headquarters in Youngstown, Ohio. E M Ikirt becomes general manager of the company's Republic Rubber Div.

Bigelow-Liptak Corp has established an office in Tulsa, Okla., under supervision of Charles F Koos. Koos will cover Oklahoma, New Mexico and a portion of Texas and Arkansas. Another office has been opened in Portland, Ore., under super-



this preheater is cutting fuel costs in hundreds of plants

the *Ljungstrom* AIR PREHEATER

The Ljungstrom operates on the continuous regenerative counterflow principle. The heat transfer surfaces in the rotor act as heat accumulators. As the rotor revolves the heat is transferred from the waste gases to the incoming cold air.

The Ljungstrom air preheater has proved its value in industrial and utility plants throughout the country. That is why every year a constantly increasing percentage of the installed boiler capacity is equipped with Ljungstrom air preheaters.

Your fuel costs will be lower too, when your boiler is equipped with the Ljungstrom air preheater. The regenerative design of the Ljungstrom permits reliable operation at low exit gas temperatures. This assures the greatest possible heat recovery . . . reduces the amount of fuel required.

If you are planning a new installation, or expanding your present one, our engineers will welcome the opportunity to show you how the Ljungstrom can raise the overall efficiency of *your* plant.

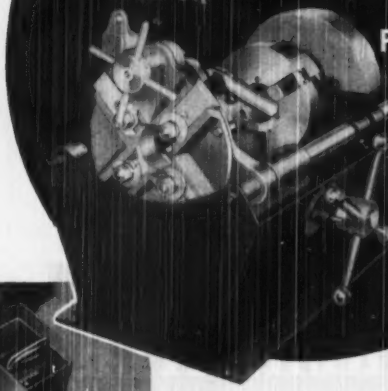
THE AIR PREHEATER CORPORATION

60 East 42nd Street, New York 17, N. Y.

SURE... Plenty!

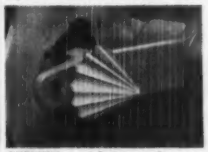
SAVE LABOR... REDUCE COSTS WITH

TOLEDO 2" PORTABLE POWER PIPE MACHINE



THREAD 2" PIPE IN 22 SECONDS

CONTROLS . . . entirely within forward and reversing switch. Speed adjusted automatically.



REAMING...with 12 tooth cone type fluted reamer mounted on arm on cutter head.

THREADING...speedy, accurate. Thread gauge shows length of thread being cut.

CUTTING...especially fast with 4 cutting knives. Perfect square end cuts. No burred edges.

Bring your costs down—save up to 80% on pipe threading time by using a portable TOLEDO No. 999 Power Pipe Machine instead of hand methods!

Gives you high production! The Super Model threads 2" pipe in 22 seconds . . . or 30 seconds with Standard Model. Cuts off 2" pipe in 10 seconds. It's versatile—quickly changed for all pipe sizes up to and including 2". It's rugged, compact, low in cost . . . with proven performance and Toledo dependability! Ask your distributor for complete details and price. Write for new catalog. The Toledo Pipe Threading Machine Co., Toledo, Ohio. New York Office: 165 Broadway, Room 1310.

RELY ON THE LEADER

TOLEDO

PIPE TOOLS...POWER PIPE MACHINES...POWER DRIVES

vision of J A Schruefer. Territory will include southern Washington and Oregon. Armin O Schleiffarth has been named St. Louis, Mo., representative. Schleiffarth and his sons, Donald and Armin D, will cover eastern Missouri and southern Illinois.

American Locomotive Co diesel engine sales and repair parts depts have been transferred from Auburn to Schenectady, N. Y. All communications relating to Alco or McIntosh and Seymour marine and stationary diesel engines and parts should be addressed to Sales Dept or Renewal Parts Dept, American Locomotive Co, Schenectady, N. Y. William G Miller has assumed duties as executive assistant to Duncan W Fraser, chairman and president of the company. Charles T Lathrop succeeds Miller as Auburn Works manager.

Carl E Buchholzer and W E Mack are appointed to staff of **Airtemp Div,** Chrysler Corp, Dayton, Ohio. Buchholzer is assistant to the president, while Mack will handle special assignments for W C Newberg, president.

Ahlberg Bearing Co, Chicago, promotes H F Hagenauer to purchasing agent. He succeeds P F McGuinn, who died last November.

Lewis H Dietz is now vice-president in charge of sales and Antto P Saha vice-president in charge of production and engineering for **Cyclotherm Corp,** Oswego, N. Y.

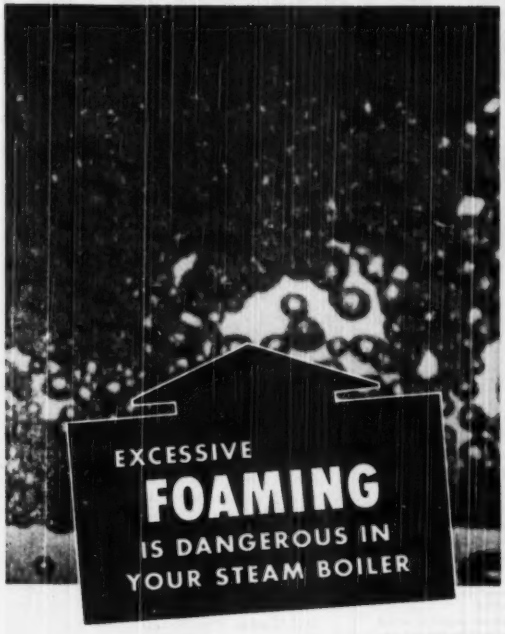
W H Brady Co has moved its office in Milwaukee to new quarters at 204 Washington St.

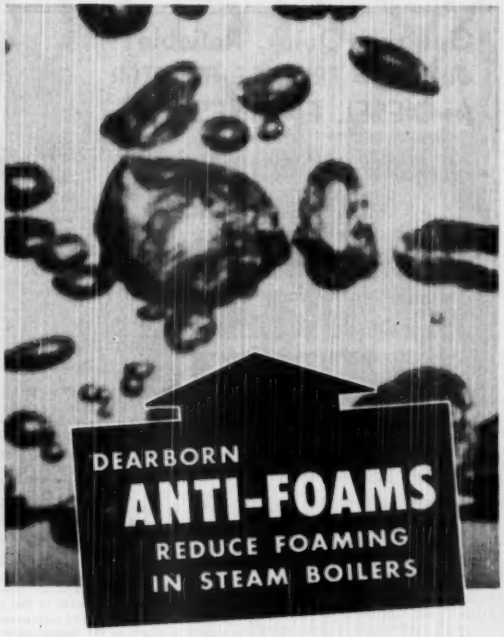
E G Schroeder becomes sales manager of **Electric Products Co,** Cleveland, Ohio. He will be responsible to G J Berry, vice-president in charge of sales, for all headquarters and field direct sales activities. Also, Sheldon Storer & Associates is selected as the firm's district representative for southwestern section of Ohio and state of Kentucky.

Ingersoll Steel Div, Borg-Warner Corp, promotes C M Baker to chief engineer of its Kalamazoo, Mich. Works. Baker succeeds L C Freeman, retired.

Gerald C Rasey will be in San Francisco headquarters of **Enterprise Engine & Foundry Co** as sales manager of the engine division.

Farrel-Birmingham Co announces the move of its gear sales div from Buffalo and marine sales div from New York City to the firm's main offices at Ansonia, Conn. R C Wilson, manager of Buffalo sales, will continue in that capacity with headquarters in Ansonia. In addition, Pierce Birkhoff and J H Allen of Buffalo sales staff also transfer to Ansonia, where they will continue to handle sale of gears, speed-reducing and speed-increasing units and flexible couplings. Sale of gear generating machines and gear cutting tools will continue at Buffalo under William C Oberem. John Brandt will remain in Buffalo ter-





DEARBORN POLYAMIDE ANTI-FOAM NO. 659 WILL REDUCE FOAMING IN ANY WATER

These high-speed motion pictures graphically illustrate how Dearborn Polyamide Anti-Foam reduces foaming. At the left, incompletely treated water forms an almost solid pattern of small bubbles. At the right, immediately after the introduction of Dearborn Polyamide Anti-Foam No. 659, the production of fewer and much larger bubbles shows complete control of foaming.

Excessive foaming in steam boilers is the cause of needless delays, shutdowns and expense. Dearborn Polyamide Anti-Foams produce purer steam . . . eliminate scale formation in feed lines, enclosed heaters and economizers . . . prevent carry-over of suspended or dissolved solids which may foul equipment and spoil materials . . . condition sludge . . . are compatible with other treatment.

If you use steam in your plant, investigate Dearborn Polyamide Anti-Foams. Dearborn, serving industry since 1887, brings you a complete water treatment and engineering service. This broad experience is at your disposal, whatever your needs in water treatment.

DEARBORN CHEMICAL COMPANY

General Offices: 310 South Michigan Avenue • Chicago 4, Illinois

Dearborn

TRADE MARK REGISTERED

THE LEADER IN WATER TREATMENT AND RUST PREVENTIVES

TWO VALUABLE BOOKLETS WRITE FOR COPIES

For information on Dearborn Polyamide Anti-Foams, write for Bulletin No. 5008. And for a complete description of Dearborn Industrial Water Treatment and Engineering Service, write for Bulletin No. 5000. The coupon is for your convenience.

Dearborn Chemical Company
Dept. PO, 310 South Michigan Ave.,
Chicago 4, Ill.

Gentlemen: Please send:

( ) Bulletin No. 5008—Dearborn Polyamide Anti-Foams

( ) Bulletin No. 5000—Dearborn Industrial Water Treatment and Engineering Service

Name.....

Company.....

Position.....

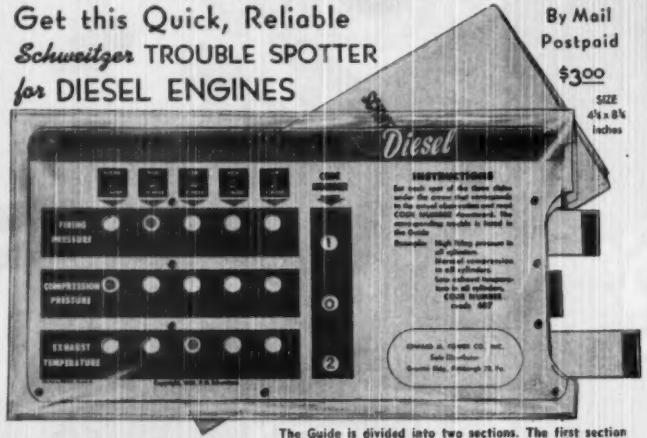
Address.....

City.....*State*.....

Get this Quick, Reliable
Schweitzer TROUBLE SPOTTER
for DIESEL ENGINES

By Mail
Postpaid
$3.00

SIZE
4¼ x 8¼
inches



Slide Rule Accuracy

This guide prepared by Paul H. Schweitzer, Dr. Eng. Penna. State College in collaboration with Diesel Engine experts enables operators and service men to locate and remedy troubles encountered in Diesel engine operation. Makes trouble spotting an easy semi-automatic process, and points unerringly to the proper remedy, thus saving a great amount of time and expense. The guide is snugly encased in stout plastic jacket.

The Guide is divided into two sections. The first section is entitled TROUBLE and it lists the code numbers for various observations, each with the corresponding trouble or troubles.

The second section is entitled DEFECTS and it deals with the origin of the various troubles.

The two sections are interlocked through a unique numbering system, which makes the use of the Guide extremely convenient.

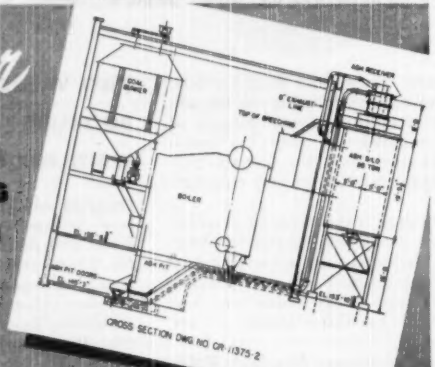
The TROUBLE section carries code numbers in the left side column. These numerals correspond to those of the Trouble Spotter, attached to this booklet.

The second column lists supplementary observations which help to diagnose the trouble or to select the correct one if one code number allows more than one.

The third column lists the probable troubles corresponding to their code numbers.

Edward M. Power Co., Inc., 602 Granite Bldg., Pittsburgh 22, Pa.

Another
COAL and ASH HANDLING INSTALLATION by BEAUMONT



Here's one of the many efficient coal and ash handling installations—designed, manufactured, installed *by Beaumont*. The above system is operating at the Philadelphia plant of Yale & Towne Manufacturing Company. This plant saved both time and expense—through one-contract-economy . . But you're right! It's up to us to convince you of the advantages in a *Beaumont* installation: So let us send you our folder of typical installations. Write to:

Beaumont **BIRCH COMPANY**
1502 RACE STREET, PHILADELPHIA 2, PA.

DESIGNERS—MANUFACTURERS—ERECTORS BULK MATERIAL HANDLING SYSTEMS

ritory as sales representative for all company products. Engineering and manufacturing depts continue at Buffalo plant. Members of New York sales staff, Norman L Shaw, manager of marine sales, William Frayne, Richard F Marsh and Elmer F Myers, are now in Ansonia.

Edmund D Haigler has joined **Fischer & Porter Co,** Hatboro, Pa., to work on special customer engineering problems.

Diehl Mfg Co announces opening of a district office and warehouse at 5900 Second Blvd, Detroit, Mich., under management of James E Ryan.

Robert H Morse Jr has been elected president of **Fairbanks, Morse & Co,** Chicago, Ill. His father, Col Robert H Morse, whom he succeeded, becomes chairman of the board.

Gil-Lair Products Inc appoints the following as its manufacturer's representatives: Tom S Andrews, Oklahoma City, Okla.; Application Co, New York City; W Philip Cox, Washington, D. C.; H A Ferguson, Baton Rouge, La.; Edwards & Son, Pittsburgh, Pa.; Walter J Ottinger, Toledo, Ohio; Keystone Tool Corp, Houston, Texas; and Paul B Mueller Co, Minneapolis. Allied Supply Co, Los Angeles, and Mission Pipe & Supply Co, San Diego, Calif., are named selected stocking distributors in their areas.

J B Sullivan becomes sales engineer at **Pennsylvania Transformer Co's** New York district sales office.

Pettibone Mulliken Corp has purchased **Johnston & Jennings Co,** Cleveland, including the Stowe Stoker Div. All manufacturing activities have been moved to 4700 W Division St, Chicago, Ill. Harry C Huston, sales manager, will continue in charge of sales and service headquarters, which will remain in Cleveland.

Iron Fireman Corp, Cleveland, Ohio, elevates the following men to newly created sales positions: Howard M Cutshaw, domestic division sales manager; Stewart H Kibbe, industrial division sales manager; and C D Carter, assistant sales manager in charge of organization development.

Arthur J Brennan is elected vice-president of **Perfex Corp,** Milwaukee, Wis.

S&C Electric Co announce that Curtis H Stout, 215 Commerce St, Little Rock, Ark., is now representing the firm in Arkansas, Louisiana, and western half of Mississippi.

Warren S Jones has been made district manager of **Rockbestos Products Corp's** new office in New Orleans, La. Territory includes Louisiana, Texas, Mississippi, Alabama, Georgia and Florida. Howard G Jones has replaced Warren Jones in Glendale, Calif. office.

Whiting Corp appoints following new hoist distributors: Wisner Inc, Rockford, Ill.; Neff Equipment Co, Toledo, Ohio; Stone Supply Co, Houston, Texas; and

TERRY

QUICK-STARTING
TURBINE
FOR FEED PUMP
EMERGENCY DRIVE

The turbine shown at the right picks up the feed-pump load in case the motor, which normally drives the unit, is inoperative. Thus the turbine must be able to start quickly and be completely reliable —characteristics which are assured by the generous blade clearances and one-piece construction of the Terry Wheel.

This is but one example of many special turbine requirements that are met by the Terry solid-wheel turbine. Details on how this and other Terry Turbines will meet your individual needs will be gladly supplied by a Terry engineer.

DATA

The turbine is 620 hp, 3560 rpm for 850 psi, 900F steam with 2.5 psi back pressure.

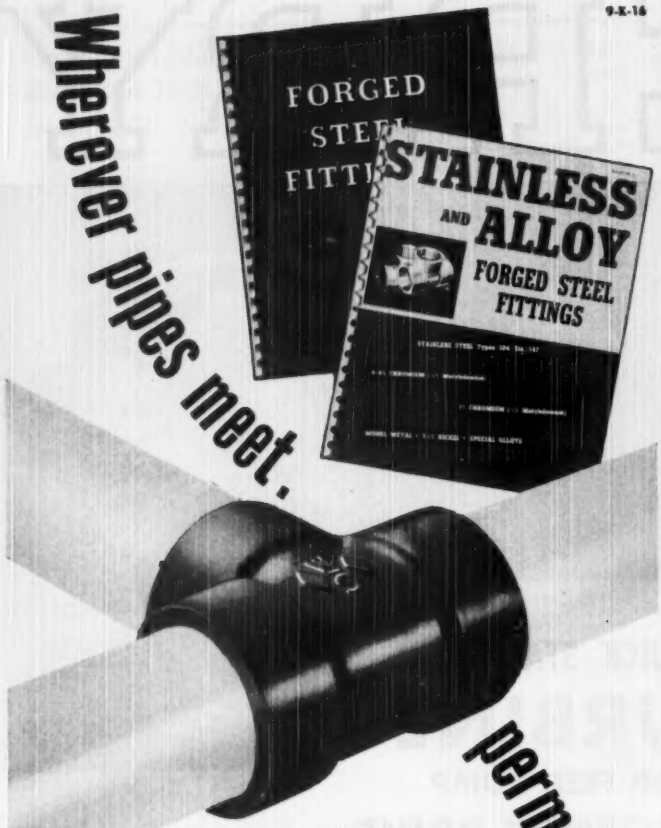
Installed in the Crawford station, Middletown, Pa., Metropolitan Edison Co. Gilbert Associates, Inc. were the consulting engineers.

T-1178

THE TERRY STEAM TURBINE COMPANY
TERRY SQUARE, HARTFORD, CONN.

9-X-16

Wherever pipes meet, permanently



IN POWER PLANTS,

the right answer to every temperature and pressure Fittings Problem is W-S Screw End and Socket Weld Forged Steel Fittings.

Basic materials are selected from a wide choice of chrome-moly, carbon and alloy steels. Designs are carefully engineered. Fittings are drop forged for strength ... precision machined for accuracy of finish, and instrument inspected for perfection of threads, sockets, angles and concentricity. Investigate them today.

Write for Bulletin A3-50. For information on Stainless and Alloy Steel Fittings, ask for Bulletin S-1.

SOLD THROUGH LEADING DISTRIBUTORS EVERYWHERE

SPECIFY...

W-S

FORGED STEEL FITTINGS

DISTRIBUTORS PRODUCTS DIVISION, ROSELLE, NEW JERSEY

WATSON-STILLMAN Established 1848

Designers and Manufacturers of Forged Steel Fittings, Valves, Wire Rope Shears, Hand Pumps, Jacks, Pipe Benders and Hydraulic Equipment

Barton Sales Co, Fort Wayne, Ind. Barton Sales Co is also distributor for Whiting's Trambeam overhead crane and monorail systems.

V L Merle is elected president of **Wright Chemical Corp,** Chicago. Other officers elected are: H C Dagget and H J Meacher —*vice-presidents*; V L Merle—*treasurer*; D R Walser—*secretary*.

Mutual Boiler Insurance Co. of Boston announces opening of two new boiler and pressure-vessel inspection territories, one at Altoona, Pa., and the other at Houston, Texas. J Stasney Jr, resident inspector for Altoona territory will work from his home at 903 Allegheny St, Hollidaysburg, Pa. J G Dawson, resident inspector in Houston, will also work from his residence at 1002 Willard St, Houston.

Donald C Luce has been named vice-president in charge of combined operations and a director of **Public Service Electric & Gas Co,** Newark, N.J., succeeding the late Jacob T Barron. Watson F Tait Jr has succeeded Luce as vice-president in charge of electric operation. Edwin H Snyder has assumed Tait's former duties of general manager of electric dept.

Unit Heater Assn elects following officers for the ensuing year: J C Patterson—*president*; H S Wheller—*vice-president*; L O Monroe—*secretary-treasurer*. Patterson is director of sales, industrial heating, Carrier Corp, and Wheller is president of L J Wing Mfg Co.

OBITUARIES

Jacob T Barron, 65, vice-president in charge of combined operations and a director of Public Service Electric & Gas Co, Newark, N. J., died March 12 in Alexian Brothers Hospital, Elizabeth, after a month's illness.

George K Miltenberger, 60, superintendent of production and distribution for Union Electric Co of Missouri, died suddenly March 6 of a heart attack while on his way to his office.

Barclay J Sickler, 44, assistant power manager of Bonneville Power Administration, Portland, Ore., died March 14 after an extended illness.

Wyllys G Hooper, 69, vice-president and director of Midwest Piping & Supply Co. died March 11 in St. Louis, Mo., of heart disease.

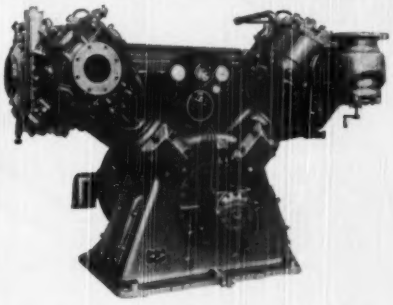
C H Buckmaster, 43, district manager for Lincoln Electric in Detroit, died March 27 as a result of injuries received in an automobile accident.

George F Gebhardt, 76, former director of dept of mechanical engineering at Illinois Institute of Technology, died March 22 at his home in Miami, Fla.

Dr Horace W Gillett, 66, former director of Battelle Institute, died March 3 from a heart attack suffered in a tourist camp near Nicholasville, Ky.

Here's a
RUGGED HEAVY-DUTY MACHINE
that supplies large air volumes with
GREATEST EFFICIENCY!

JOY WN-114 AIR COMPRESSOR



The JOY WN-112 is a two-cylinder, heavy-duty, continuous type unit, having all the features of the WN-114. It delivers 368 to 1828 CFM, up to 3656 CFM in twin units.

Check these Features:

- Delivers 1092 to 3656 CFM, up to 7312 CFM in twin units
- Four Cylinders, two stage, double acting, water cooled
- Requires less room, costs less to install
- Exclusive Dual Cushion Valves are more efficient, have longer service life
- Exclusive Load Control assures lower operating costs
- Simpler design—Longer life—Less maintenance

WRITE FOR BULLETINS, OR

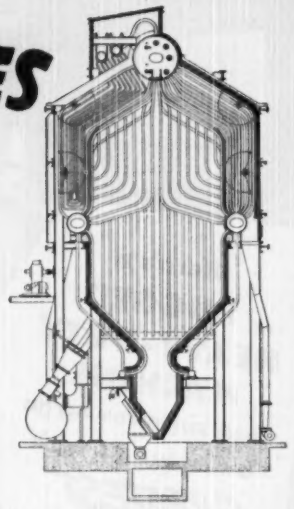
Consult a Joy Engineer

WBD 12927

JOY MANUFACTURING COMPANY

GENERAL OFFICES: HENRY W. OLIVER BUILDING · PITTSBURGH 22, PA.
IN CANADA: JOY MANUFACTURING COMPANY (CANADA) LIMITED, GALT, ONTARIO

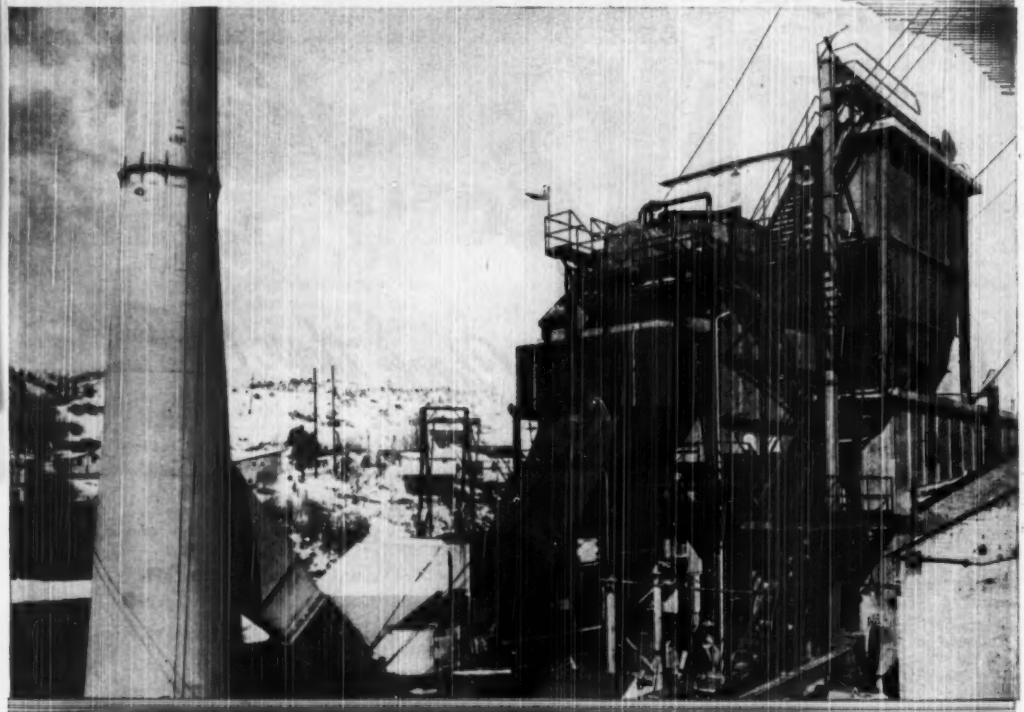
UNION OUTDOOR STEAM GENERATING PLANT *in the* ROCKIES



This Union "H" Type steam generator requires no costly building to house it. The steel cased boiler with superheater, dust collector, air heater, ducts, fans and stacks are out-of-doors, at 6500 feet elevation.

It is designed for 60,000 pounds of steam per hour at 450 psig and 750 Deg. F., fired with pulverized coal, oil and gas combination fuel burning equipment.

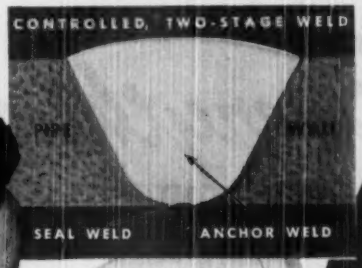
The superheater is located on one side only, providing constant superheat over a wide load range by automatic adjustment of the boiler outlet dampers controlling the gas flow across the superheater.



UNION IRON WORKS • • *Since 1890*

201 Cascade Street • Erie, Pa., U. S. A.

BOILERS • PROCESS EQUIPMENT • FABRICATED STEEL



WHY GRAPPLE WITH PIPING PROBLEMS?

Are you always grappling with piping problems that keep you pinned down and prevent you from doing a hundred and one other necessary things? If so, free yourself to do those "other necessary things" that only you can do. We have the "know-how," experience and shop facilities to prefabricate your piping from preliminary engineering to final completion. For 50 years we have been solving all kinds of piping problems, large and small, and have kept pace with engineering advances in the use of high pressures and high temperatures. Our repeat contracts with both power and industrial plants are proof of our engineering and skill in a most exacting business. Why grapple, then, with your next piping job? You can depend on us to handle it from beginning to end. Also, ask us about the Mitchell-Westport Joint which prevents weld metal protrusions inside the pipe without using backing rings. Write for our bulletin, "Something New in Welding."

REPRESENTATIVES IN BOSTON, NEW YORK, CLEVELAND, MOBILE AND HAVANA

MITCHELL

WILMOT STOCKS LARGEST CHOICE OF CHAIN SIZES, ATTACHMENTS

Also C. I. or Steel Flights, Sprockets, Traction Wheels, Take-ups, Shafting, Bearings, Casings, Trough, All other Needed Parts

For a working load of 250,000 lbs., the main feed conveyor in the above installation suggests the wide range of capacities of Wilmot conveyors. Over 5,600 feet of our conveyors serve this coal breaker.

As the originator of Rivetless chain conveyors, Wilmot manufactures a complete line of parts for all sizes of coal, sludge and ash conveyors. We stock the largest choice of chain sizes available: in pitches from 3" to 10½" and working loads from 3,000 to 130,000 lbs.; of drop-forged alloy steels, normalized or heat-treated.

As shown in our 280-page catalog, Wilmot also supplies the widest choice of attachments. We have, or will design, everything for your conveyor from sprocket to traction wheel. Hundreds of plants cut "down" time by depending on Wilmot for prompt replacement parts.

Send for
NEW 280-PAGE
BOOK on CHAINS
Conveyors, Elevators

Full engineering data for designers or maintainers of hauls, conveyors or elevators. Abundantly illustrated.

WILMOT ENGINEERING CO.

HAZLETON, PA.
Plant:
WHITE HAVEN, PA.

Wilmot Coal Preparation Equipment: Hydrotators • Hydrotator-Classifiers • Hydro-Separators • Simplex Jigs Crushing Rolls • Sizing Shakers • Bucket Elevators • Conveyors • Car Hauls • Keystone Rivetless Chain, etc.

WILMOT BUILDS BETTER BREAKERS

ASHCROFT DURAGAUGE

"Progressive Research has meant continuous leadership for over 100 Years"

A few Ashcroft "firsts" that have anticipated the needs of industry:

1921—Ashcroft introduces the micrometer adjustable pointer.

1924—The rotary movement is announced by Ashcroft.

1929—The phenol condensate plastic case is an Ashcroft "first" this year.

1932—Bourdon Tubes of stainless steels are announced by Ashcroft research engineers.

1936—Stainless steel movements, for greater service life, join the long list of Ashcroft Gauge features.

1939—"K" Monel Bourdon Tubes, for services that would corrode stainless steel, introduced by Ashcroft.

1939—Laminated phenol dials make this year a big one in Ashcroft development.

1947—Ashcroft research engineers announce the new, revolutionary Nylon Movement*.

*Pat. applied for.

1850—A century of service to American Industry—1950

MAXWELL MANNING M&M MOORE INC. TRADE MARK

ASHCROFT *Gauges*

A Product of

MANNING, MAXWELL & MOORE, INC.

STRATFORD, CONNECTICUT

1850 ASHCROFT U.S.A.

Makers of 'Ashcroft' Gauges, 'Hancock' Valves, 'Consolidated' Safety and Relief Valves, 'American' Industrial and 'Microsen' Electrical Instruments. Builders of 'Shaw-Box' Cranes, 'Budgit' and 'Load Lifter' Hoists and other lifting specialties.

For STRENGTH specify

TRI-LOK

RECTANGULAR

OPEN STEEL FLOORING

The locked-in strength of Tri-Lok enables it to stand up under heavy loads—even on long spans. No rivets, bolts, or welds are used in the construction of Tri-Lok; this feature eliminates the possibility of loose joints.

Tri-Lok is also available in Diagonal, or Super-Safety U-type Flooring, and in Stair Treads of all types. Write for Bulletin KM 1140.

DRAVO CORPORATION

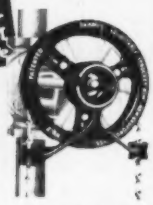
National Distributor for the Tri-Lok Company

Dravo Bldg., Pittsburgh 22, Pa.

Sales Representatives in Principal Cities

DRAVO

Babbitt *Adjustable* **SPROCKET RIM** *with Chain Guide*



INSTANT
POSITIVE
CONTROL

for ALL Overhead Valves

- Pull the chain! That's all that's needed to open or close overhead valves—for complete control from the floor! Operating action of the BABBITT Adjustable Sprocket Rim with Chain Guide is as positive and immediate as that of direct manual control—and 100% safer because the risks of climbing treacherous stepladders, or on benches, machines or boilers is completely eliminated.

- The BABBITT Adjustable Rim fits all valves, with either rising or non-rising stems. It is installed quickly by clamping onto the hand wheel of the valve.

- Range of 10 adjustable sizes takes care of all valve makes and types; fits valve wheel diameters from 2 to 30 inches. Write today for Catalog Bulletin P, surprisingly low prices, and name of nearest distributor.

BABBITT STEAM SPECIALTY CO.

1 Babbitt Square, New Bedford, Mass.

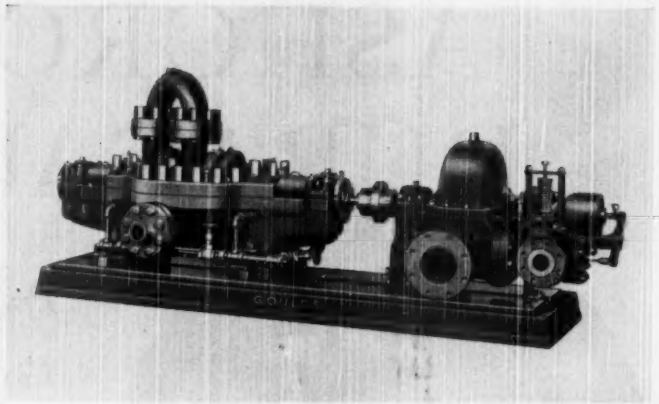


Fig. 3360

For high pressure boiler feed service . . . Goulds multi-stage centrifugals

TYPE: Centrifugal, multi-stage, single suction, side suction impellers, horizontally split case, with ball bearings. Available either motor or steam turbine drives.

Capacities: up to 1300 G.P.M. Pressures: up to 1200 lbs. depending on capacity. Sizes: 3" to 6". Fully described in Bulletin 722.5. Copy gladly sent on request.

USES: For high pressure high temperature boiler feed service or for any other similar heavy duty service where the utmost in dependability is essential.

ADVANTAGES: Specifically designed for high pressure boiler feeding and similar service. Heavy construction. Built in two to eight stages. Hydraulically balanced. May be dismantled without disturbing pipe connections. Made in all-iron, bronze-fitted, or special constructions.

Other Examples of Goulds Complete Line

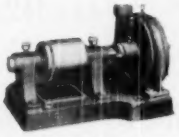


Fig. 3010—Cap. 5 to 100 G.P.M. Heads to 70 ft. Sizes 1", 1½", 2". Open impeller—inexpensive.

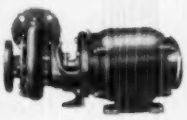


Fig. 3650—Cap. to 2000 G.P.M. Heads to 400 ft. Sizes 1" to 6". Close-cupled for general service.

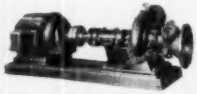


Fig. 3105—Cap. 250 to 4500 G.P.M. Heads to 220 ft. Sizes 4" to 8". Heavy duty open impeller type for paper stock, etc.

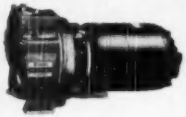


Fig. 3648—Cap. to 35 G.P.M. Pressures to 190 lbs. Sizes ¼ H.P. to 5 H.P. Centrifugal-jet type.

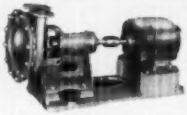


Fig. 3705—Stainless Steel—Cap. to 600 G.P.M. Heads to 200 ft. Sizes 1" to 3". Especially designed for corrosive liquids.

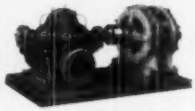


Fig. 3450—Cap. to 15,000 G.P.M. Heads to 500 ft. Sizes 2" to 16". Double-suction single-stage type.

Goulds Has The Right Pump For Your Job

The above are only six of the more than 180 types and sizes of pumps that Goulds makes. Pumps are our only business—have been for over 100 years.

The *right pump* for your job saves you money. Phone or write Pump Headquarters or your nearest Goulds representative for their recommendation on any pump job you may have.

MEMBER

Goulds PUMPS INC.

Seneca Falls New York

BEACON COAL

EASTERN GAS AND FUEL ASSOCIATES

PITTSBURGH • BOSTON • CHICAGO • CLEVELAND • DETROIT • NEW YORK
NORFOLK • PHILADELPHIA • SYRACUSE

For New England: New England Coal & Coke Co., For Export: Cosmar, Curran & Bullitt Inc.

for TUBES

call on B.T.A.

BOILER TUBE CO. OF AMERICA

McKEES ROCKS, PA. (Pittsburgh District)

YOU CAN CUT PIPING COSTS with CATAWISSA PERFECT SEAL UNIONS

CATAWISSA HOT FORGED STEEL UNIONS priced to compete with better grade malleable iron unions

also . . . DOUBLE EXTRA HEAVY FORGED STEEL SWING CHECK VALVES 600-lbs. W.S.P.

a type for every use! CATAWISSA STAINLESS STEEL UNIONS machined from solid bars

WRITE FOR BULLETIN 10-A

CATAWISSA VALVE & FITTINGS CO.
206 Mill St. • CATAWISSA, PA.

Monsanto SANTOBRITE controls slime and algae in cooling towers

Slime and algae, enemies of good cooling tower operation, are kept under control by Santobrite (Monsanto's sodium pentachlorophenate, technical). Santobrite is economical...easy to use...efficient.

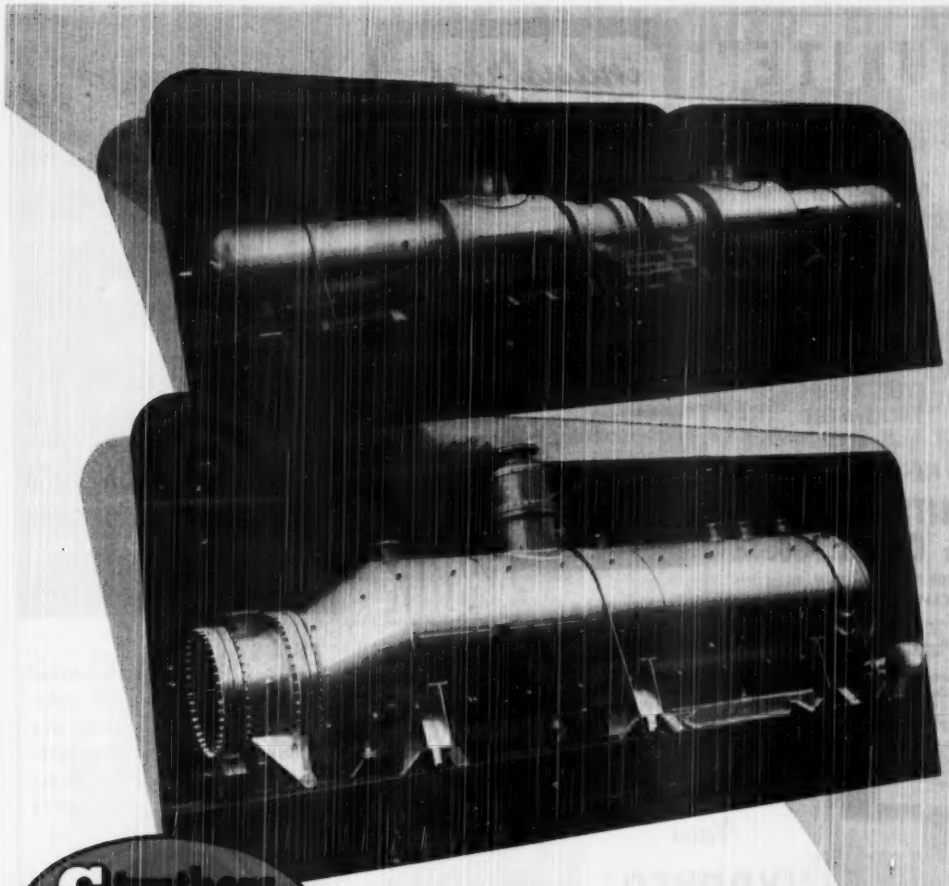
If slime and algae cause trouble in your cooling towers, it will pay you to read Monsanto Technical Bulletin No. O-15. For your copy, contact the nearest Monsanto Sales Office or write: MONSANTO CHEMICAL COMPANY, Desk A, 1763 South Second Street, St. Louis 4, Missouri.

Santobrite: Reg. U. S. Pat. Off.

DISTRICT SALES OFFICES: Birmingham, Boston, Charlotte, Chicago, Cincinnati, Cleveland, Detroit, Houston, Los Angeles, New York, Philadelphia, Portland, Ore., San Francisco, Seattle. In Canada, Monsanto (Canada) Ltd., Montreal.

MONSANTO
CHEMICALS — PLASTICS

SERVING INDUSTRY . . . WHICH SERVES MANKIND



Struthers Wells

FEEDWATER HEATERS
WATER EVAPORATORS
for
a Central Station Expansion

The large water evaporator and low pressure feedwater heaters shown are a part of the equipment furnished recently for a large central station expansion.

Every week, throughout the country, more Struthers Wells closed feedwater heaters and water evaporators take their place in new modern plants for the efficient and economical production of steam power.

For true economy, both in first cost and on a long term basis, Struthers Wells equipment merits your consideration.

Write for Bulletin B-17 on your letterhead.

STRUTHERS WELLS CORPORATION

Process Equipment Department . . . Warren, Pa.

PLANTS AT WARREN, PA. · TITUSVILLE, PA. **OFFICES IN PRINCIPAL CITIES**

"GUNITE" Concrete

(SINCE 1915)

Linings for

STEEL BUNKERS •
DUCTS, HOPPERS •
STACKS •
UPTAKES •
BREECHINGS •

• • •

STEEL & PIPE ENCASEMENT

• • •

FIREPROOFING •

GUNITE CONCRETE & CONST. CO.

1301 Woodswether Road
KANSAS CITY 6, MO.

R. N. Turner, Dist. Mgr., 220 No. La Salle St., Chicago 1, Ill. B. H. Mueller, Distr. Mgr., 6825 Delmar Blvd., University City, (St. Louis), Mo. Philip D. Barnard, Distr. Mgr., 2956 Addison, Houston 6, Tex.

Branch Offices: New Orleans, Dallas, Denver.
"See our catalog in Sweet's"

industrial
OIL AND GAS BURNING EQUIPMENT

- Mechanical Atomizing Oil Burners
- Steam Atomizing Oil Burners
- Refractory Burner and Muffle Blocks
- Industrial Gas Burners
- Low Air Pressure Oil Burners
- Fuel Oil Pump Sets
- Valves, Strainers, Furnace Windows
- Tandem Block Combustion Units
- Combination Gas and Oil Burners

Detailed information gladly sent you upon request.

NATIONAL BURNER

AIROIL

NATIONAL BURNER COMPANY INC.

1250 East Sedgley Avenue, Philadelphia 34, Pa.
Southwestern Division:
2512 South Boulevard, Houston 6, Texas

If your plant requires

- DIRECT HEATING OF VAPORS
- DIRECT HEATING OF LIQUIDS
- DOWTHERM INDIRECT HEATING
- STEAM GENERATORS
- STEAM SUPERHEATERS
- WASTE HEAT BOILERS

place the selection of the specific type in specialized hands . . . and obtain optimum efficiency.

Petro-Chem Development Company engineers are heating specialists . . . they can supply the whys and wherefores of indirect versus direct heating and the economics of both.

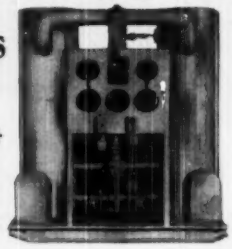
Every day more than 600, oil and gas fired, Petro-Chem Iso-Flow* installations in the petroleum, chemical and allied industries, demonstrate the efficiency of their design and installation.

***Patents issued and pending**

PETRO-CHEM DEVELOPMENT CO., INC.
120 East 41st Street, New York 17, N. Y.

Representatives:
Bethlehem Supply, Tulsa and Houston • Flagg, Brackett & Durgin, Boston • D. D. Foster, Pittsburgh • Faville-Levally, Chicago • Lester Oberholz, Calif.

Pritchard's *New* HYDRYER*



- **For Efficient Drying of Compressed Air and Other Gases**
- **Packaged Units for Instrument Air and Industrial Processes**
- **Only Service Connections Required**

Pritchard HYDRYERS are unexcelled for efficiency and dependability in drying air for instrument and process controls. Standard packaged units are designed to reduce dew points of compressed air and other gases to minus (—) 40° F. No special installation required. Specially designed units may be built to your requirements.

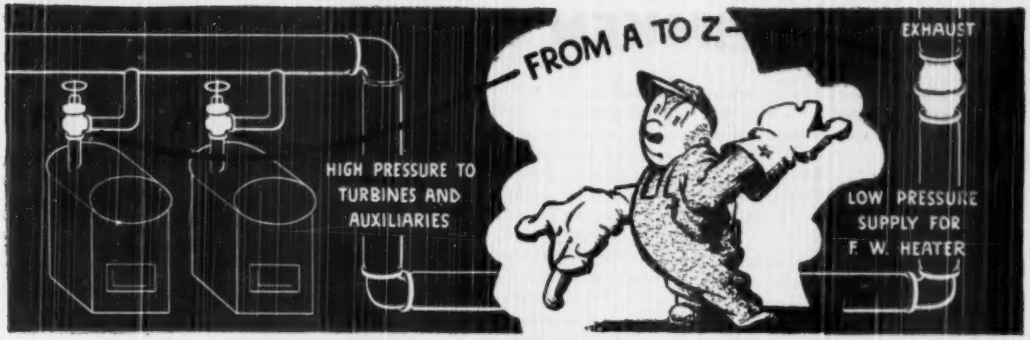
Write for FREE Bulletin No. 16.0.080

* Registered Trade Name

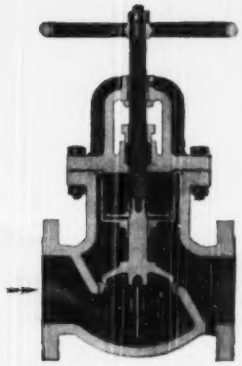
EQUIPMENT DIVISION
J.F. Pritchard & Co.
Dept. No. 9 — 908 Grand Ave., Kansas City 6, Mo.

District Offices:
Chicago • Houston • New York • Pittsburgh • Tulsa • St. Louis
Other Representatives in Principal Cities from Coast to Coast

SAVE MONEY IN YOUR PLANT



—with FOSTER AUTOMATIC VALVES



FOSTER AUTOMATIC NON-RETURN Stop and Check Valve, Type 2

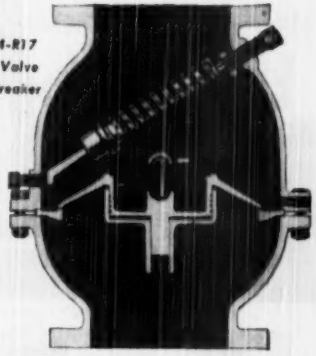
A . . . On your boiler drums, Foster Automatic Non-Return, Stop and Check Valves save money by doing their job perfectly—with the absolute minimum of attention—for years. It is not unusual to find these valves still giving good service after 25 or 30 years and more. Today's valves are even better.

There's nothing skimpy about a Foster Type 2. Full pipe area means negligible pressure drop across the valve. Heavy duty, through bolted construction makes it safe to work under when the boiler is down. Low pressure types to 250 lbs. (stocked) have semi-steel bodies, bronze trimmed, with stainless steel seat rings; high pressure types to 1,500 lbs. have cast steel bodies, trimmed with special heat resisting, corrosion resisting alloys. Piston chambers are renewable. They're built for lifetime service. Globe, angle, or elbow, from 2½" to 12".

Z . . . The R-17 Back Pressure Valve saves money by keeping the pressure where you want it on the exhaust side—for your feed water heater or other low pressure equipment—with a minimum of maintenance. Large pipe area, and large valve area mean low pressure drop across the valve, and sensitive action at low pressures. Saves make-up steam. Adjustable in ounces.

The R-17 has no outside stuffing boxes or external weights. Loading spring is on the atmosphere side of the valve and is accessible for inspection through a large handhole. Renewable seat ring and dash pot. 2½" to 20", (with sizes from 4" to 12" stocked).

Foster Type 34-R17 Back Pressure Valve and Vacuum Breaker



• • • All along the line—Foster Pressure Regulators, Temperature Regulators, Pump Governors, Float Valves, Safety Valves, Check Valves, Relief Valves and Safety Valves are designed and built to save money, by giving reliable, trouble free regulation with a minimum of maintenance. When you select the proper Foster Valve and install it correctly, you are making a sound investment, backed by more than 70 years of practical experience in building good valves, and our reputation for service.

FOSTER ENGINEERING Company

PRESSURE REGULATORS . . . RELIEF AND BACK PRESSURE VALVES . . . CUSHION CHECK VALVES . . . ALTITUDE VALVES . . . FAN ENGINE REGULATORS . . . PUMP GOVERNORS . . . TEMPERATURE REGULATORS . . . FLOAT AND LEVER BALANCED VALVES . . . NON-RETURN VALVES . . . VACUUM REGULATORS OR BREAKERS . . . STRAINERS . . . SAFETY VALVES . . . SIRENS

835 LEHIGH AVENUE • UNION, N. J.

Timber goes up—costs come down—with TIMKEN® roller bearings

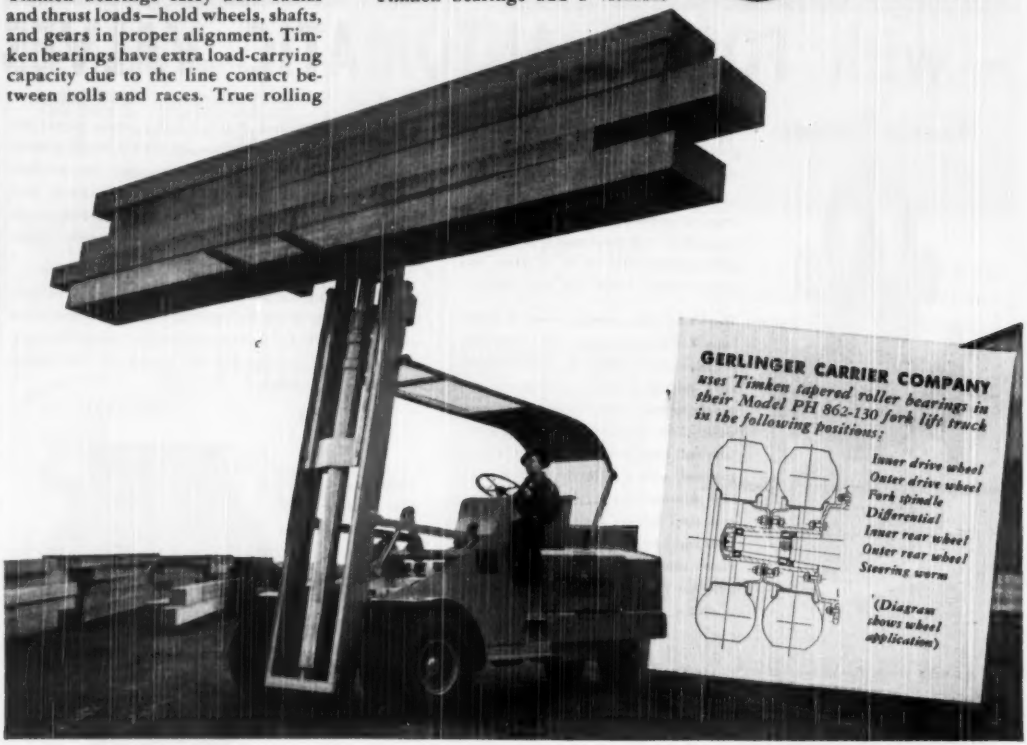
YARD work goes faster when timber is handled with fork lift trucks. And the cost is low—especially when your truck is Timken bearing-equipped like this Gerlinger Model PH 862-130. Timken bearings help keep your lift truck on the job and out of the repair shop.

With Timken bearings, excessive wear on moving parts is eliminated. Because they're tapered in design, Timken bearings carry both radial and thrust loads—hold wheels, shafts, and gears in proper alignment. Timken bearings have extra load-carrying capacity due to the line contact between rolls and races. True rolling motion and incredibly smooth surface finish practically eliminate friction.

Maintenance and lubrication are reduced because Timken bearings help closures effectively retain lubricants. Under normal usage, Timken bearings last the life of the machine because they are (1) carefully engineered for the job, (2) made of Timken fine alloy steel, and (3) precision manufactured.

Timken bearings add a valuable sales feature to your product—build greater acceptance among your customers. When you specify tapered roller bearings, specify "Timken". And when buying new equipment, always look for the trade-mark "Timken" on the bearings. The Timken Roller Bearing Company, Canton 6, Ohio. Cable address: "TIMROSCO".

This symbol on a product means its bearings are the best.


GERLINGER CARRIER COMPANY
uses Timken tapered roller bearings in their Model PH 862-130 fork lift truck in the following positions:
Inner drive wheel
Outer drive wheel
Fork spindle
Differential
Inner rear wheel
Outer rear wheel
Steering worm
(Diagram shows wheel application)

DESIGN LEADERSHIP

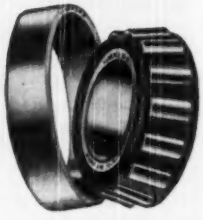
The first Timken tapered roller bearing was produced in 1898. Since then the one-piece multiple perforated cage, wide area contact between roll ends and ribs, and every other important tapered roller bearing improvement have been introduced by The Timken Roller Bearing Company.

The Timken Company leads in: 1. advanced design; 2. precision manufacture; 3. rigid quality control; 4. special analysis steels.

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

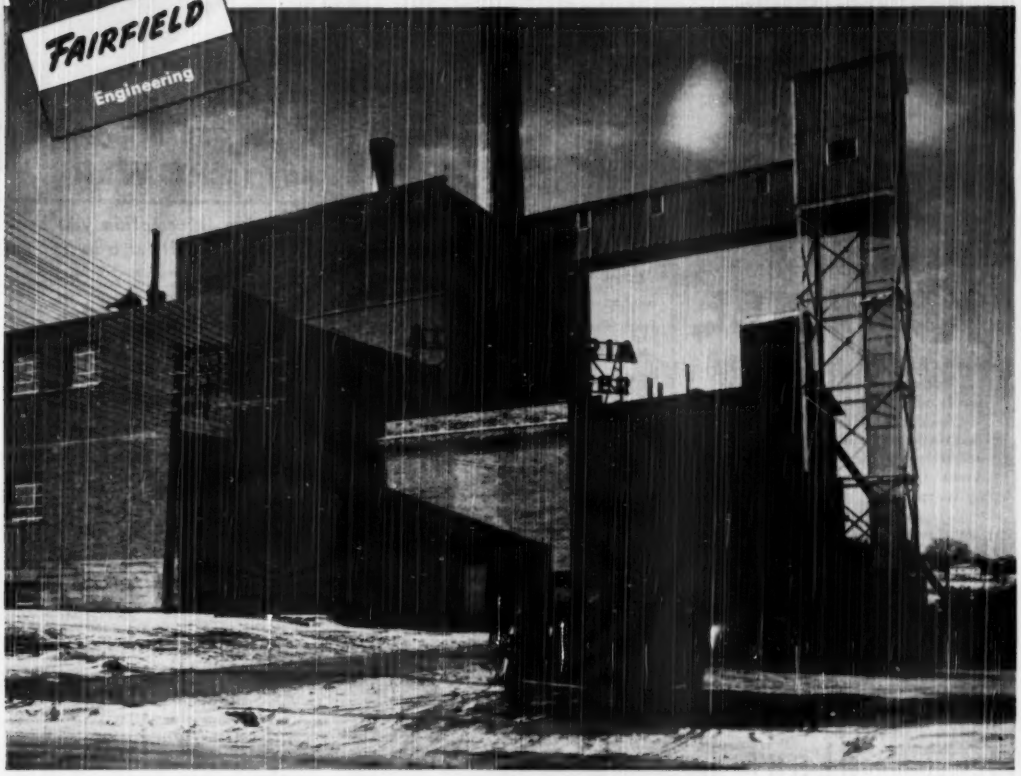
TAPERED ROLLER BEARINGS



NOT JUST A BALL ○ NOT JUST A ROLLER ⊂⊃ THE TIMKEN TAPERED ROLLER ⊂⊃ BEARING TAKES RADIAL ⊂⊃ AND THRUST →⊂⊃← LOADS OR ANY COMBINATION

Progressive FAIRFIELD Engineering

SERVING THE NATION'S POWER PLANTS



bringing the mountain to Mohammed

Today's story of the mining of raw materials, transporting them over countless miles, conveying and preparing these raw materials for conversion to energy at a constant and controlled rate, far exceeds the imaginary feat of "bringing the mountain to Mohammed".

Actually, for Fairfield Engineering, the feat of designing and building conveying systems, storage facilities, accurate boiler feeding devices to meet specific power plant needs has been a daily record of accomplishment for many years. For instance, the northwest municipal installation shown above . . . Fairfield engineers were called in to expand the existing Fairfield installation to serve an additional boiler. Specific requirements indicated a bucket elevator fed by an apron feeder from the track hopper. For loading the bunker, a tripper equipped belt conveyor loaded from the bucket elevator. Automatic scales, gates and chutes to pulverizers completed the installation.

This is but one example of the countless number of power plants across the country that has profited from Fairfield engineering and "know-how" over the past 35 years. If you contemplate overhauling, expanding, or improving your power plant operation, your experienced Fairfield engineer can serve you wisely. Write or call—

THE FAIRFIELD ENGINEERING COMPANY

335 Chicago Ave., MARION, OHIO

High Pressure Steam at Low Cost

SCOTTIE JR®

KEWANEE®

6 sizes for 6 to 36 hp at 100 lbs wp . . . For coal, oil or gas . . . hand or mechanically fired.

Check the proportions of each Scottie Jr. and you'll see why it will actually produce approximately double the horse power guaranteed by its rating.

WRITE Department 99-K5
for 6" scale with pipe diameter markings

KEWANEE BOILER CORPORATION
KEWANEE, ILLINOIS

Branches in 50 Cities—Eastern District Office: 45 West 45th Street, New York City 36
Division of American Radiator & Standard Sanitary Corporation

---

New Printings Available

STEAM TURBINES
•
STEAM GENERATION

Because of continuing demand for these comprehensive and authoritative special sections, we have just made an additional printing and can now supply new orders. Price remains the same: 60¢ for single copies, 51¢ for 100 or more, 46¢ for 500 or more, 41¢ for 1000 or more, and 37¢ for 2000 or more.

Address your orders to:
Editorial Dept.

POWER

330 W. 42nd St., New York 18, N. Y.

There's always room and big pay in POWER

Here's the information you need to equip yourself for a better job

Hundreds of men are using this practical library to reach the top in the power plant field. It brings you a complete education in power plant practice; it packs between the covers of 6 concise volumes a wealth of information on boilers, steam engines, steam turbines, pumps, boiler-feed apparatus, etc. Not only do you get the "how to" of every phase of power plant work, but this library gives you the fundamental principles in back of each phase and tells you "where," "when," and "why" a job should be done in a particular way.

The Library of

POWER PLANT PRACTICE

By TERRELL CROFT

6 volumes, 2477 pages, 2404 illustrations

Here are the results of years of experience with power plant problems . . . an accurate on-the-job guide to getting the right answers quickly and with remarkable ease. The Library of POWER PLANT PRACTICE is the one standard reference work in the field . . . the set you can turn to with confidence on any power plant problem.

Covers power plant work inside-and-out

Every important division of power plant practice is explained for you in a clear, easy-to-understand way . . . from the selection of engines to the operation of electrical equipment . . . from a basic, clear explanation of the "stickers" you meet up with in your work to analyses and solutions to the big troublesome problems . . . all plainly worded and explained with clear illustrations. Every page is packed with the kind of information that the power plant man wants and needs in his daily work.

6 powerful self teachers

1. Steam Boilers
2. Steam Engine Principles and Practice
3. Practical Heat—Part I
4. Practical Heat—Part II
5. Steam Turbine Principles and Practices
6. Steam Power Plant Auxiliaries and Accessories.

SEND NO MONEY

Examine these books yourself — FREE

With a little spare-time reading you can have the identical knowledge possessed by the highest paid engineers. They make big money because they know Power Plant Practice from A to Z . . . here's your opportunity to join their ranks! Return the coupon below and we'll send you all six books for 10 days' free examination. After 10 days you are free to return the books without obligation . . . or, if you decide to keep them, to pay in easy monthly installments as outlined below.

JUST MAIL COUPON

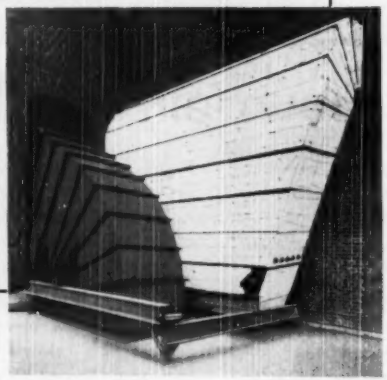
McGRAW-HILL BOOK COMPANY, Inc.
330 W. 42nd St., NYC 18

Please send me Croft's LIBRARY OF POWER PLANT PRACTICE, 6 volumes, for 10 days' examination on approval. In 10 days I will remit $3.50 and $3.00 monthly until the total price of $18.50 is paid, or return the books without obligation.

Name .....
Address .....
City ..... Zone ..... State .....
Company .....
Position P-5-50

This offer applies to U. S. only

Ask LITTLEFORD about Breechings and Ducts



Get Quality Fabrication

Talk over that next job with Littleford, the source of the finest powerhouse fabrication of every kind. We fabricate any size and shape you want, in any weight of metal. Modern facilities for shearing, punching, bending, rolling and welding, plus skilled craftsmen, combine to assure excellent quality. It will pay you to show us specifications and get quotation.

FABRICATORS OF PLATE AND SHEET METALS

LITTLEFORD

LITTLEFORD BROS., INC.
438 E. Pearl St., Cincinnati 2, Ohio

DUCT WORK—BREECHINGS
ELECTRICAL ENCLOSURES—STACKS
TRANSFORMER HOUSINGS—TANKS
CONTROL DESKS—INSTRUMENT PANELS
CUBICLES—PIPING—CABLE PANS

you get longer service—greater safety with

Pittsburgh Seamless Boiler Tubes

You get longer service and greater safety with Pittsburgh Seamless Boiler Tubes for these important reasons. The steel is produced in a selected, closely controlled analysis range which assures uniform density for the entire length of the tube and from tube to tube. The seamless process gives you a tube that has the toughness and ductility to operate at high pressures and temperatures with safety.

The inherent homogeneous soundness of Pittsburgh Seamless Boiler Tubes has been proved again and again by the long service with safety they provide. Specify Pittsburgh Seamless for your next installation. For additional information write Pittsburgh Steel Company, Dept. P, Grant Building, Pittsburgh 30, Pa.

P

Pittsburgh Seamless Boiler Tubes

a product of

Pittsburgh Steel Company

LEAK DETECTORS

find leaks quickly

With G-E leak detectors you can easily locate even the smallest leaks in closed systems. Detectors are ideal for locating leaks in installed equipment or in the products you make.

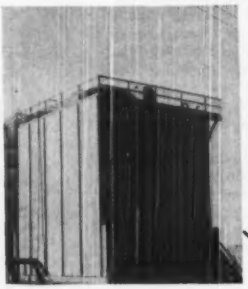
Use the Type H detector for pressure systems, the Type M for evacuated systems.* Write for Bulletin GEC-233 (Type H) or for GEC-336 (Type M). *Address Apparatus Dept., Y687-21, General Electric Co., Schenectady 5, New York.*

**If the system is filled with combustible gas, write for special application information.*

GENERAL ELECTRIC

ant-21

"Our best ads are installed . . ."



Two coil induced draft cooling tower.

COOLING TOWERS
WOOD TANKS
STAINLESS TANKS
WOOD PIPE
MULTI-FIN UNITS

since 1903

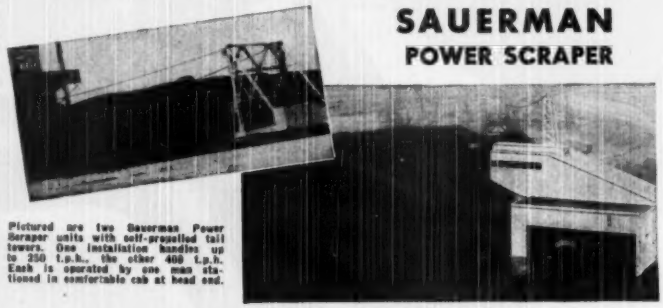
SANTA FE
TANK & TOWER CO.

ENGINEERS • FABRICATORS • ERECTORS

5401 S. Boyle Ave., Los Angeles 11

Branches: New York, Boston, Chicago, Tulsa, Houston, San Francisco

It's *easier* to stockpile coal with a SAUERMAN POWER SCRAPER



Pictured are two Sauerman Power Scraper units with self-propelled tail towers. One installation handles up to 250 t.p.h., the other 400 t.p.h. Each is operated by one man stationed in comfortable cab at head end.

The new trend in coal storage methods, as exemplified by Sauerman Power Scraper systems, features easier work for the operator as well as faster movement of coal by the equipment.

All recent improvements in Sauerman coal-handling equipment have reinforced the ability of the scraper operator to spread the coal adequately, to pack the coal uniformly, and to operate effectively in all kinds of weather without inconvenience.

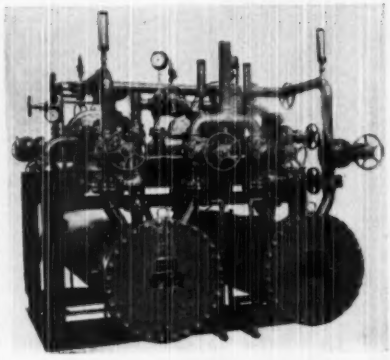
Coal piles built the Sauerman way are insured against spontaneous combustion. The Crescent scraper bucket, in moving across the pile, rakes the fines into the voids, eliminating air pockets and thoroughly compacting the coal.

WRITE FOR THE SAUERMAN COAL STORAGE CATALOG

SAUERMAN BROS., Inc., 562 S. Clinton St., Chicago 7, Ill.

LOCKETT FUEL OIL PUMPING AND HEATING SETS

Custom Built

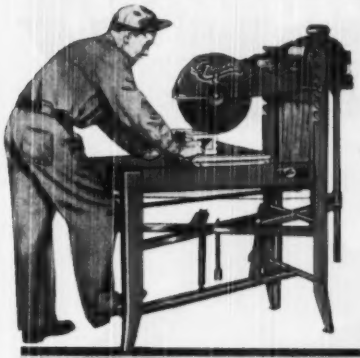


The compact, high-pressure unit illustrated consists of two, Turbine-driven Rotary Pumps and two, Shell-and-tube-type Oil Heaters mounted on a single frame.

FOR almost a half century, Lockett has been supplying, to fit individual needs, efficient standard and custom-built, Fuel Oil Pumping and Heating Sets, for mechanical and steam atomizing oil burners. Combinations of various types of pumps are available: Either two Turbine-driven Pumps; one Electric-driven and one Turbine-driven Rotary Pump; two Electric-driven Rotary Pumps; two Worthington Duplex Steam Pumps; or one Duplex Steam Pump and one Electric-driven Pump. Each pump-and-heater is suitable for the full rated capacity of the unit; the second pump and heater are spares. Lockett supplies everything, complete. Inquiries are invited. *Descriptive bulletins sent on request.*

A. M. LOCKETT & COMPANY, LTD.
Contracting Mechanical Engineers
NEW ORLEANS - HOUSTON - DALLAS - GALVESTON

I NEVER WOULD HAVE BELIEVED IT - BUT I SAW IT DONE!



Yes! I SAW THE 1950 Clipper MASONRY SAW MAKE THESE CUTS in SECONDS

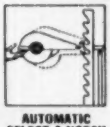
Make your own special shapes from standard refractory stock—easy, fast, economical. Clipper-Cut precision fits eliminate breakouts, spalling, costly down-time. Salvage obsolete materials by cutting to desired size.

SPLITS—SKEWS—ANGLES—SOAPS—WEDGES—NOTCHES—FEATHER-EDGES—STRAIGHTS . . . Any Cut *in Seconds* with CLIPPER!

THE FREE TRIAL RIGHT IN OUR PLANT CONVINCED EVERYONE FROM THE PLANT AND MAINTENANCE SUPERINTENDENT TO THE MASONS... THAT PRECISION "TAILOR-MADE" CUTS LESSENED "DOWN TIME" -A REAL SAVING TRY A CLIPPER TODAY!

. . . DIRECT FROM THE FACTORY

PATENTED EXCLUSIVE CLIPPER FEATURES



AUTOMATIC SELECT-A-NOTCH

One man easily adjusts Cutting Head to desired height. Operators hands merely guide. All weight is supported by rear bar.

AUTOMATIC BLADE PRESSURE

Makes your blades last longer because Equalizer Spring Automatically cushions blade pressure on HARD or SOFT materials.

ADJUST-A-CUT CONTROL

Merely pull the knob—and the cutting head is free for "finger-tip" setting at any desired angle. Release knob and lock.

ONE-SPOT OPERATION

From ONE SPOT at the front of this Clipper the operator performs every cutting operation and makes all saw adjustments.

WET-OR-DRY PUMP

No need to remove belt when cutting dry. No maintenance... Factory Sealed. An exclusive Clipper development.

SAVE-A-BLADE "NO GUESS WORK"

Automatically cushions pressure on Clipper Superior Abrasive blades. Also protects valuable Clipper Diamond blades. Match arrows. An exclusive patent.

THE ORIGINAL MASONRY SAW

Clipper MANUFACTURING CO.

NATION-WIDE DIRECT FACTORY SERVICE

KANSAS CITY 8, MISSOURI

Cable Address: CLIPPER K C Mo

PHILADELPHIA • ST. LOUIS • CLEVELAND • AUSTIN, TEX.
SAN FRANCISCO • CHICAGO • NEW YORK • PITTSBURGH

DRY ABRASIVE | DIAMOND BLADE | WET ABRASIVE

CUT WET or CUT DRY
There's a Clipper Blade for Every Job!

MAIL THE COUPON NOW!

CLIPPER MANUFACTURING COMPANY 78
19 E. 28th ST • KANSAS CITY 8, MISSOURI

Send TODAY information on the FREE TRIAL offer and complete literature and prices on the 1950 Clipper Masonry Saws.

NAME_____

COMPANY_____

STREET_____

CITY_____ ZONE_____

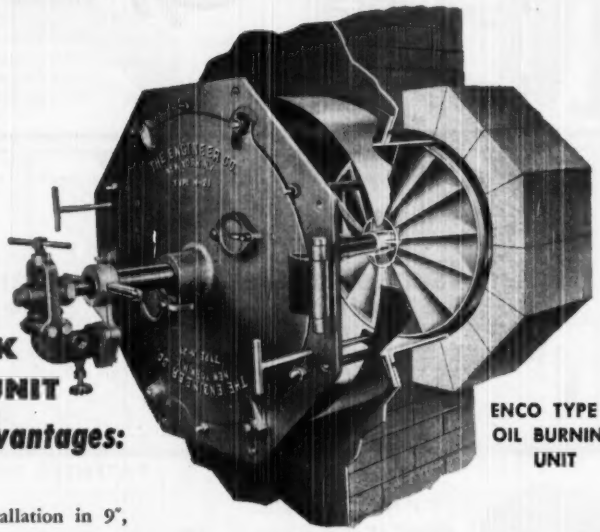
STATE_____

NOW! uniform combustion efficiency from high peaks to low loads with the

ENCO TYPE K

OIL·GAS BURNER UNIT

HERE'S THE LATEST advance in burner units, designed to provide completely uniform combustion over the entire load range. The new ENCO Type K Oil-Gas Burner Unit is especially effective where steam demands swing sharply over short periods.

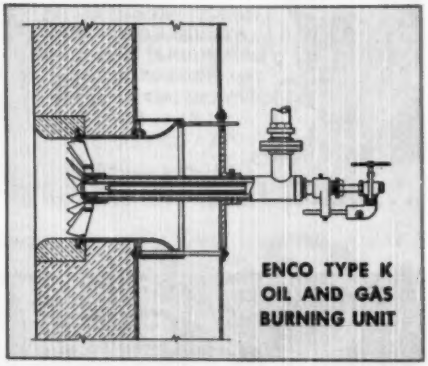


ENCO TYPE K OIL BURNING UNIT

THE ENCO TYPE K OIL·GAS BURNER UNIT *Offers These Additional Advantages:*

1 Natural or forced draft operation.
2 Register draft tube designed for installation in 9", 13½", 18" and 22½" furnace walls.
3 No movable blades.
4 Air vanes provide fixed turbulence over entire load range. Adjustable for long or short flame.
5 Air volume control damper.
6 Hinged door for easy access to internal parts for inspection or removal.
7 Suitable for either steam or mechanical atomizing type oil atomizers.
8 Gas burner gun can be added for combination of gas and/or oil.
9 Comes in a wide range of sizes and capacities.

This new Type K Unit is the result of pioneering research, aimed to help you achieve more efficient, more economical boiler operation. Write today for further information, or see your local Enco Representative.



ENCO TYPE K OIL AND GAS BURNING UNIT

EC-479

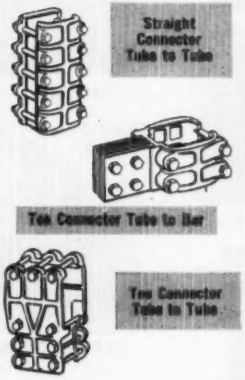
THE ENGINEER COMPANY

75 WEST STREET, NEW YORK 6, N. Y.

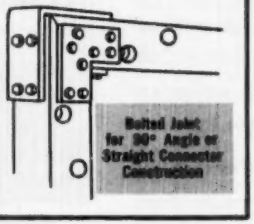
MAKE CONNECTIONS THREE WAYS

...with Chase Square Copper Bus Conductors!

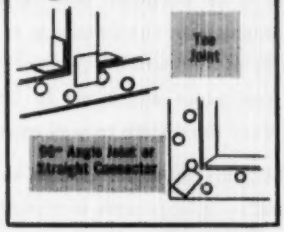
1 CLAMP TYPE JOINTS



2 BOLTED JOINTS



3 BRAZED JOINTS



THREE different types of connections can be used on installations of Chase Square Copper Bus Conductors—clamping, bolting or brazing. In addition, the four flat sides permit adequate and uniform pressure to be exerted between the large contact surfaces, resulting in firm, secure joints.

For information on other advantages of Chase Square Copper Bus Conductors, ventilated and unventilated, send for our FREE illustrated booklet to Dept. P-550.

Chase

the Nation's Headquarters for
BRASS & COPPER

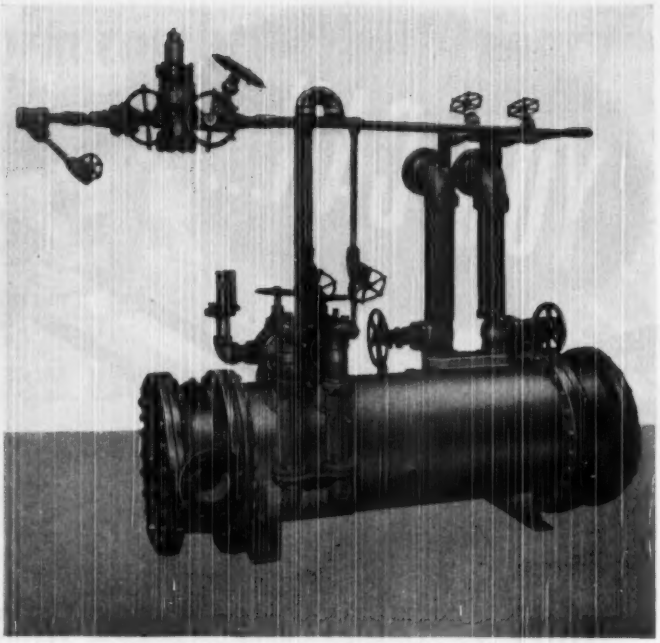
WATERBURY 20 CONNECTICUT

SUBSIDIARY OF KENNECOTT COPPER CORPORATION

THIS IS THE CHASE NETWORK . . . handiest way to buy brass

ALBANY† ATLANTA BALTIMORE BOSTON CHICAGO CINCINNATI CLEVELAND DALLAS DETROIT INDIANAPOLIS KANSAS CITY, MO. LOS ANGELES MILWAUKEE MINNEAPOLIS NEWARK NEW ORLEANS NEW YORK† PHILADELPHIA† PITTSBURGH PROVIDENCE ROCHESTER† ST. LOUIS SAN FRANCISCO† SEATTLE WATERBURY (Home Office Only)

The twin-element Conseco two-stage Steam Jet Air Ejector that will serve the 20,000 sq. ft. Conseco Condenser to be installed as part of Puerto Rico's power facilities expansion program.



A VITAL LINK IN PUERTO RICAN ECONOMIC PROGRESS

This Ejector is complete with pressure reducing valve, socket-welded steam piping and Conseco thru-type Air Meter. It is one of the largest power plant type ejectors to be equipped with combined inter and after condensers. The simplicity of design and accessibility of all operating parts are a result of Conseco's continuous endeavors to furnish equipment that is easy to operate as well as easy to repair.

In addition to the ejector shown here, Conseco has furnished or is in process of building, evaporators, low pressure feed water heaters, high pressure feed water heaters and condensers for the Puerto Rican industrial development program.

•

CONSECO Engineers are at your command to design and build condenser and heat exchanger equipment to your requirements and guaranteed to meet or exceed performance specifications.

CLOSED HEATERS

CONDENSERS

EVAPORATORS

BOILERS

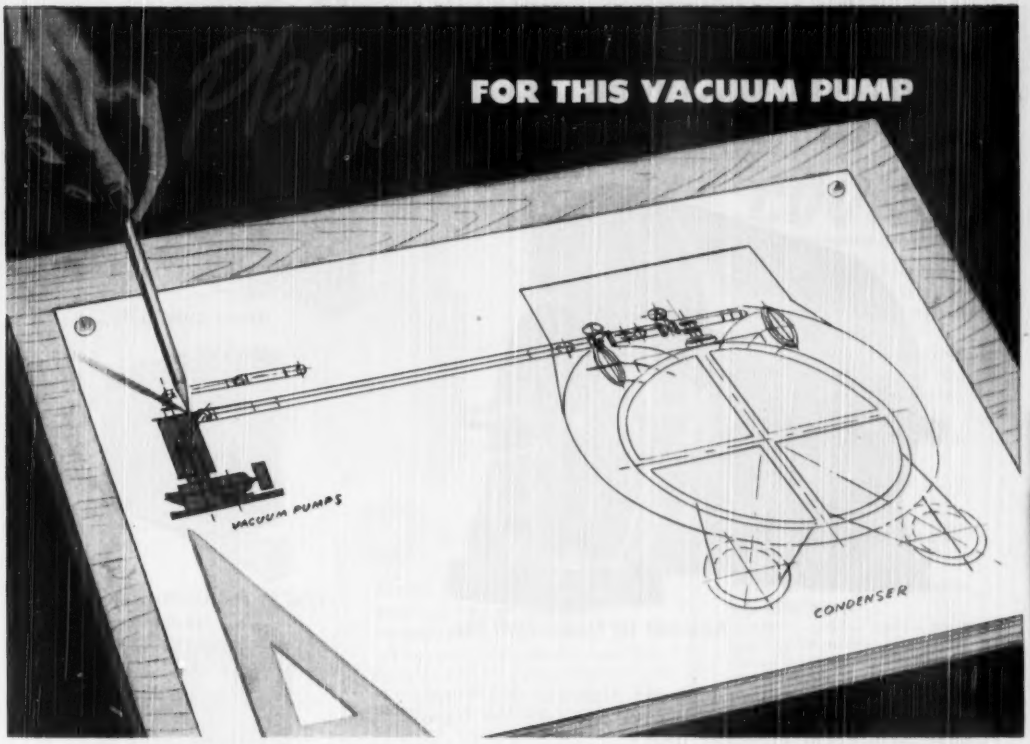
DEAERATORS

Write for bulletins covering Ejectors, Evaporators, Condensers, Boilers, Coolers, Pumps.

CONSECO

Condenser Service & Engineering Co.

HOBOKEN, N. J.



Kinney Rotary Vacuum Pumps are the real answer for controlling condenser vacuum in high pressure steam generating stations. Notable plants now using these units demonstrate their many big advantages:

1 **High pumping efficiency** from atmospheric pressure down to a fraction of an inch Hg. abs. No need for auxiliary evactors . . . Kinney Rotary Vacuum Pumps solve the complete condenser vacuum problem both at starting and under regular running conditions.

2 **Simplified plant operation.** Kinney Rotary Vacuum Pumps, like other motor-driven units, can be monitored right at your central control room. This eliminates the cost of controlling valves and ejectors at widespread locations.

3 **Uniform performance** — practically without maintenance. There are no critical apertures and no fine nozzles to clog and cause trouble. Kinney Rotary Vacuum Pumps are rugged, trustworthy . . . designed to give top-notch service, year in and year out.

4 **Reduced contamination of boiler water.** Kinney Rotary Vacuum Pumps sweep out harmful ammonia, carbon dioxide, and other corrosive gases — instead of concentrating them.

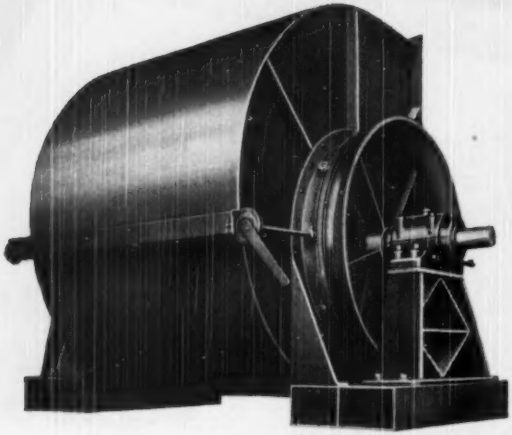
5 **Simplified piping layout** — no need for high-pressure steam lines to steam-jet ejectors. Kinney Rotary Vacuum Pumps permit the ideal piping layout — a single steam line from boiler to turbine.

Kinney Engineers will gladly work with you to obtain these advantages in your power plant. Make sure your plans include Kinney Vacuum Pumps. Send for "Use of Mechanical Vacuum Pumps in Central Station Operation" — a detailed engineering report including actual installation drawings. Also Kinney Bulletin V-45, the complete story on Kinney Rotary Vacuum Pumps.

KINNEY MANUFACTURING CO.
3532 WASHINGTON ST., BOSTON 30, MASS.
Representatives in New York, Chicago, Cleveland, Houston, New Orleans, Philadelphia, Los Angeles, San Francisco, Seattle. *Foreign Representatives:* General Engineering Co. (Radcliffe) Ltd., Station Works, Bury Road, Radcliffe, Lancashire, England . . . Horrocks, Roxburgh, Pty., Ltd., Melbourne, C. I. Australia . . . W. S. Thomas & Taylor Pty., Ltd., Johannesburg, Union of South Africa . . . Novelectric, Ltd., Zurich, Switzerland.

KINNEY Vacuum Pumps

Worth looking into (we say)...
AMERICAN BLOWER HS FORCED DRAFT FANS



American HS Forced Draft Fan

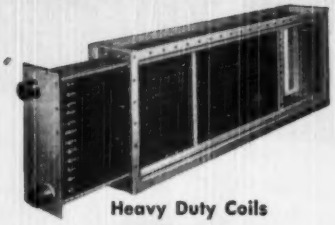
We are particularly proud of our American HS Forced Draft Fan (shown above), designed specially for forced draft applications in power plants.

Over the years, refinements in design and proportions have materially increased static efficiencies. The streamline inlet overlapping wheel rim prevents entry loss and turbulence and aids in obtaining high efficiency. Housings are of heavy welded steel up to 3/8" in thickness, with flanged outlet connections, and are reinforced for maximum rigidity.

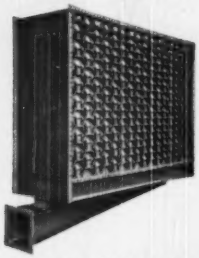
We'd like to give you the complete story on our HS Forced Draft Fan, including performance curves, placement suggestions and other important factual data. Just send for our Bulletin 4424 or call our nearest branch office for a copy.

And, if you'd like complete data on other American Blower Mechanical Draft Equipment as well as on Fly Ash Precipitators, Heavy Duty Coils and Gyrol Fluid Drives for fan control and boiler feed pumps—merely write, stating your requirements, or phone our nearest branch office.

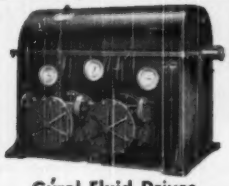
AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO
Division of AMERICAN RADIATOR & Standard Sanitary CORPORATION



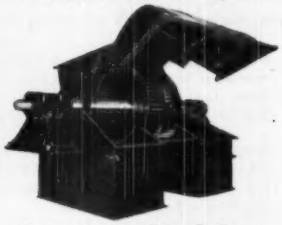
Heavy Duty Coils



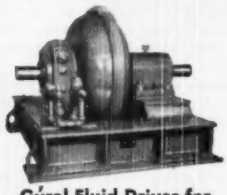
Type ST Fly Ash Precipitators



Gyrol Fluid Drives for Boiler Feed Pumps



Sirocco Induced Draft Fans



Gyrol Fluid Drives for Mechanical Draft Fans

YOUR BEST BUY AMERICAN BLOWER POWER PLANT EQUIPMENT

Serving home and industry

AMERICAN-STANDARD · AMERICAN BLOWER · CHURCH SEATS · DETROIT LUBRICATOR · KEWANEE BOILERS · ROSS HEATER · TONAWANDA IRON

ELGIN Double Check WATER SOFTENER

Your BEST BUY on ALL COUNTS

Of course the foremost reason for installing an Elgin "Double-Check" Water Softener is its proved ability to deliver up to 44% more soft water than other softeners of the same size using the same type of zeolite.

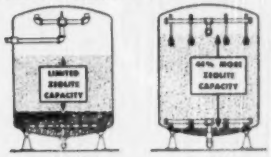
But even if it were not ahead of other zeolite softeners on this count, it would still be your best buy on the solid basis of quality construction which together with conscientious servicing when required, maintains every Elgin installation at peak efficiency. Here is why Elgin is the best buy on all counts:—

1 DESIGN

Double-Check principle gives you up to 44% more soft water

Yes, the "Double-Check" design gives you up to 44% more soft water from the same size softener using the same type of zeolite — proved in thousands of installations.

It does this because the "Double-Check" manifold system prevents the escape of zeolite and thus permits using a larger amount of zeolite in a given-size tank. More zeolite means more water softening of course. Preventing its escape also permits faster, more thorough back-washing; assures more effective regeneration; reduced salt consumption; higher efficiency; maximum economy. The two diagrams below tell the story of this revolutionary development.



ORDINARY DESIGN — ELGIN DESIGN

Same Size Units . . . Same Type Zeolite

2 QUALITY

Better construction means more years of low cost operation

When you examine the present-day Elgin you find that we have put not only advanced design into it, but also higher quality and finer workmanship.

There is none of the assembled, thrown-together construction that is too prevalent today; no skimping of materials. Instead you find well designed, Elgin-built components that assure longer life and trouble-free operation. Contrast the precision-built Elgin Multiport Valve, "Double-Check" Manifold, Backwash Regulator, with the construction found in other softeners and you will know how much more real value you get in the Elgin.

Thanks to elaborate tooling and modern streamlined production methods you pay no more for the higher quality of the Elgin "Double-Check" Softener.

3 SERVICE

Elgin servicing maintains top efficiency

Complete, capable service has always been an important plus factor with Elgin. Our interest never ends with the sale. Through the years it has always been our established policy to keep every Elgin installation operating at peak efficiency and to aid the operator in obtaining greatest benefits from its use. Elgin's service program, now better than ever, has been placed on an organized, concrete schedule which assures your realizing the outstanding performance which every Elgin product is designed to give.

"DOUBLE-CHECK" CAN BE APPLIED TO YOUR PRESENT SOFTENER

Existing softeners of any make can be modernized to incorporate the features and advantages of the Elgin "Double-Check" principle. Many modernization jobs equipped with "Double-Check" and Elgin high capacity zeolites have stepped up capacity 3 to 10 times.

Write today for facts about the softener that is ahead on all counts

ELGIN SOFTENER CORPORATION, 130 N. Grove Ave., Elgin, Ill.

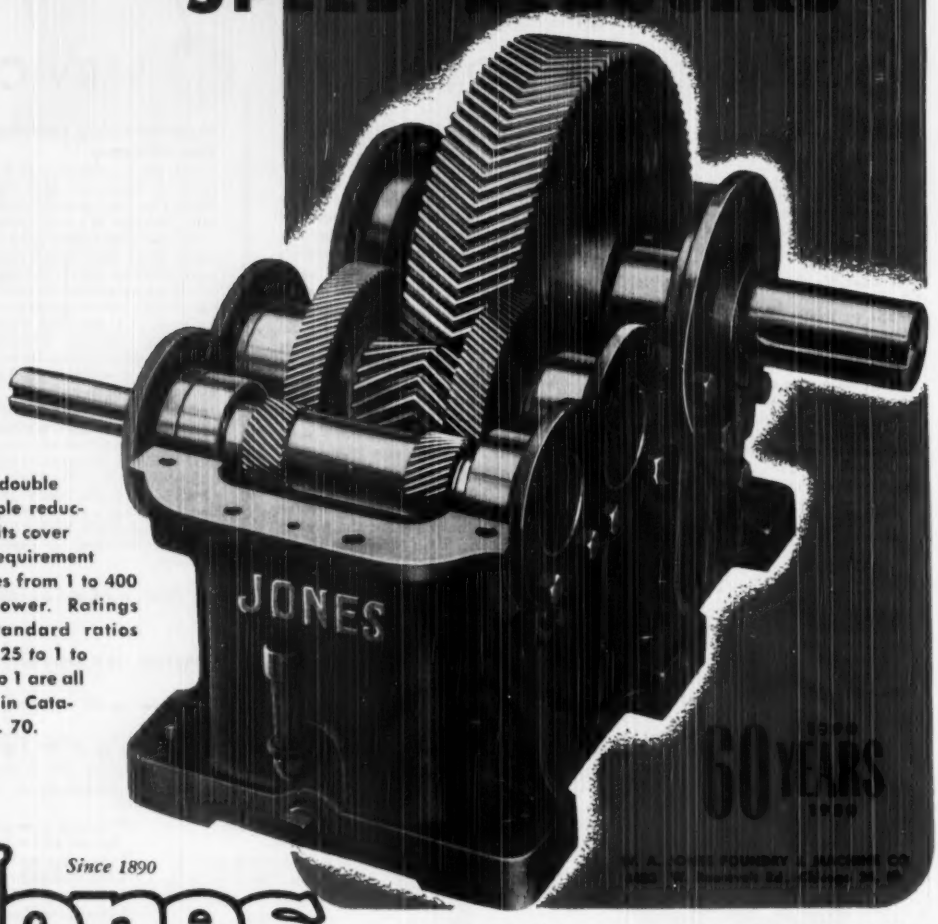
Put your water conditioning up to the Elgin man

Unlike the man who deals with one or two conditions, the Elgin District Engineer can select the best method from all methods. For Elgin methods include:

- Boiler feed water treatments
- Post treatments for softener water
- Corrosion prevention in steam systems
- "Deconcentrator" for removing boiler sludge
- Corrosion prevention in hot and cold water piping
- Filters and purifiers
- Iron removal systems
- Aerators and degasifiers
- Chemical feeders
- Water testing apparatus
- Zeolites of all types

Jones

Herringbone SPEED REDUCERS



Single, double and triple reduction units cover every requirement in drives from 1 to 400 horsepower. Ratings and standard ratios from 1.25 to 1 to 355.8 to 1 are all shown in Catalog No. 70.

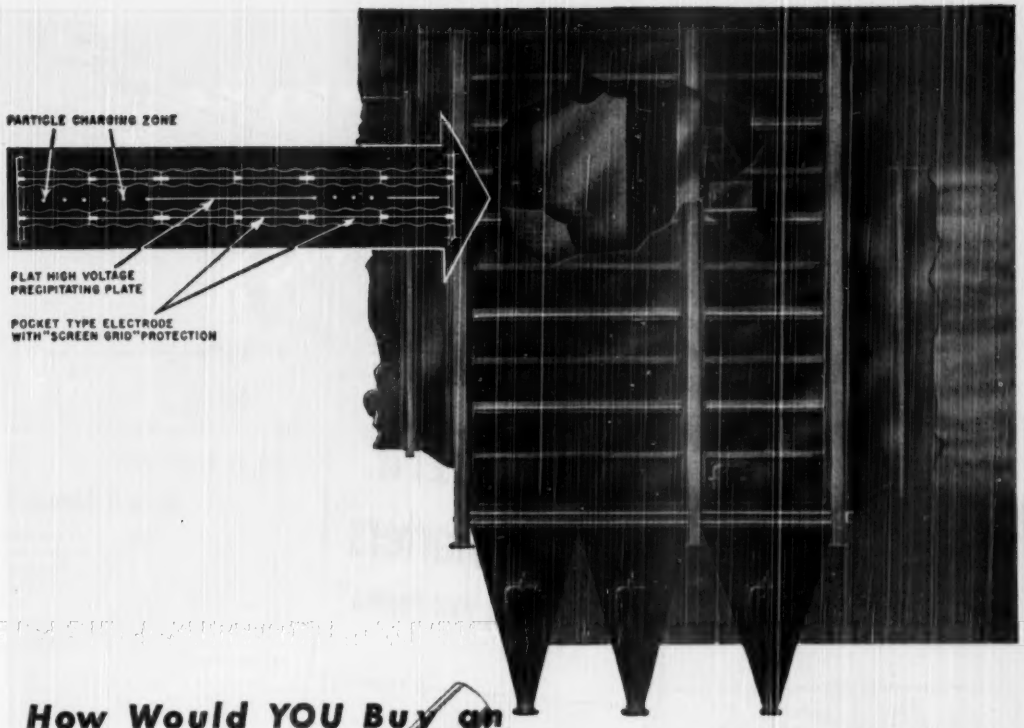
60 YEARS

Since 1890

Jones

In The Service Of Industry

HERRINGBONE—WORM—SPUR—GEAR SPEED REDUCERS
PULLEYS • GEARS • V-BELT SHEAVES • ANTI-FRICTION
PILLOW BLOCKS • FRICTION CLUTCHES • FLEXIBLE COUPLINGS



How Would YOU Buy an

ELECTRICAL PRECIPITATOR?

The basic elements of all electrical precipitator units are fundamental. All require a shell or casing with an inlet and outlet, the charging electrodes, precipitating or collecting electrodes, some form of rapping device, and a high voltage power supply.

The design of these elements, however . . . and their application to the process of electrical precipitation, is the governing factor between mediocrity and startling success.

It is highly important then, that the specifying engineer thoroughly investigate the refinements and latest developments on these basic elements and their overall effect on operating efficiency of the precipitator he is considering.

An investigation will indicate that the Aerotec Electrical Precipitator is far advanced in the four basic steps of precipitation:

1. Charging the particle.
2. Forcing charged particle to collecting electrodes.
3. Releasing the electrical charge.
4. Deposition in storage hopper.

Aerotec high voltage electrodes are subdivided for maximum effectiveness in charging and precipitating functions. Highest precipitating force is developed between flat plates, which provide a uniform field of high intensity.

To reduce the possibility of reentrainment of particles in the gas stream, Aerotec has developed a new "pocket type" collecting electrode. This unique design insures a dead zone surrounding the electrodes for maximum efficiency on both coarse and fine dusts. Release of carbon particles by induced charge, and loss of performance due to "backionization" are reduced to a minimum by this exclusive Aerotec design. Alternate rapping of the collecting electrodes reduces emission and minimizes stack "puffing" during rapping periods.

The Aerotec electrical precipitator is an ideal secondary for the Aerotec Mechanical Design 3 RAS, a combination that assures the highest efficiency possible in dust collection . . . an efficiency that will meet the most stringent dust requirements of today . . . and tomorrow.

AEROTEC

Project & Sales Engineers

THE THERMIX CORPORATION

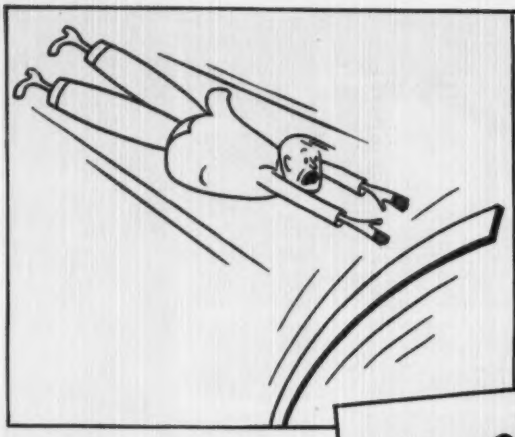
Greenwich, Conn.

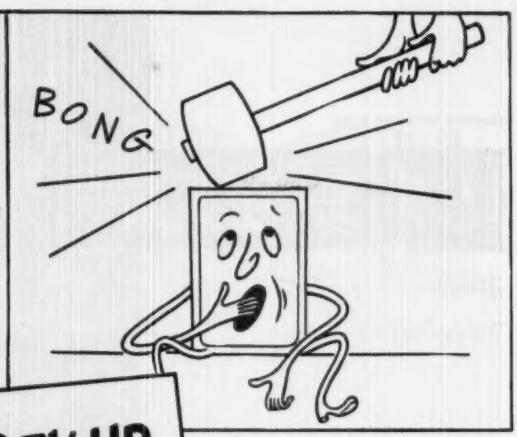
(Offices in 28 principal cities)

Canadian Affiliates: T. C. CHOWN, LTD., 1440 St. Catherine St., W., Montreal 25, Quebec

THE AEROTEC CORPORATION

GREENWICH, CONNECTICUT





Fast-Acting on Overload or Stalled Rotor Conditions

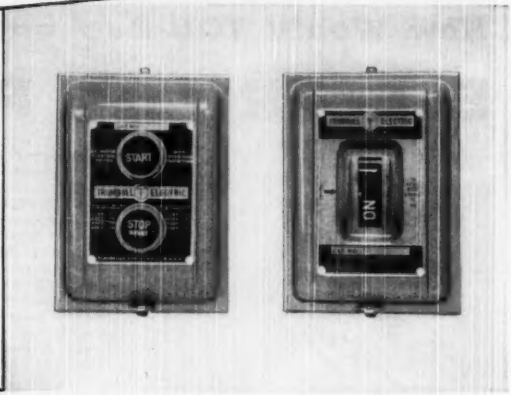
Improved thermal overload device is factory-calibrated to follow normal heating curve of motor. Handles *both* overload and stalled rotor. Trips promptly—the higher the overloads, the faster the response. Choice of 90 heater units in fractional ampere steps.

New 2-7½ HP Manual Starters

save "crossing your fingers"

But It Won't Act When It Shouldn't

Unique latch mechanism minimizes false trip-out. A trigger mechanism gives positive, quick-acting tripping on overload—reacts only to bending of heater strip, not to vibration or knocks. And metal guard protects toggle or push-button from accidental operation.



It's Even Hard for the Operator to Do Wrong

No parts to replace after overload. Contacts cannot be held closed against overload. ON, OFF, RESET positions clearly indicated on toggle type; START and STOP on push-button types. Resetting directions clearly visible on both types. Line and load circuit numbers on barriers between contacts. Covers and toggle can be locked.

PT Means "Push-button or Toggle" ...in All Sizes

All sizes of Trumbull's PT Starter available with push-button or toggle operation in general purpose enclosures. Water-tight or explosion-proof enclosures are also available. Fine silver, butt-type contacts are easily inspected. Write for Bulletin PT. THE TRUMBULL ELECTRIC MANUFACTURING COMPANY, Plainville, Conn.

TRUMBULL (T) ELECTRIC

TRUMBULL'S TRAINLOAD OF NEW PRODUCTS

Designed and Built by The Kuljian Corporation

THIS beautiful building houses one of the largest power plants ever designed and built for the Far East.

During preliminary negotiations, The Kuljian Corporation offered the Client the following choices:

1. Kuljian services to engineer and design the project, including engineering supervision of the Client's contractors.
2. Kuljian construction forces to build the plant including initial operation—if engineering is awarded to others or done by Client's own staff.
3. Kuljian organization to design and build the plant complete from original survey to and including initial operation—on a one-contract, one-responsibility basis. This was the method selected.

Whichever plan you decide upon, The Kuljian Corporation, with all its facilities and vast experience in the fields of engineering and construction, and with a magnificent record behind it, stands ready to serve you.

ST. PETERSBURG, FLA.
WASHINGTON, D. C.
ROME, ITALY
CALCUTTA, INDIA
CARACAS, VENEZUELA

The Kuljian Corporation

ENGINEERS • CONSTRUCTORS

1200 NORTH BROAD STREET, PHILADELPHIA 21, PA.

MILTON Roy

"Packaged" Systems

for BOILER WATER CHEMICAL TREATMENTS

The necessity is well recognized for feeding various chemicals to boilers for the prevention of scale and to control alkalinity, remove dissolved oxygen, protect against embrittlement and insure against corrosion and pitting caused by impurities in the boiler feed water. Practically all competent authorities agree that two distinct methods for conditioning boiler water are necessary.

First, sodium sulfite should be fed continuously to the suction side of the boiler feed pump to react with and remove any residual dissolved oxygen in the boiler feed water. This is necessary because oxygen in the water will act to corrode and pit the boiler feed water pump, economizers and boiler drums and tubes.

Second, other internal treating chemicals should be fed directly into the boiler drums to precipitate incrusting solids, to control alkalinity, and to give a chemical balance in the boiler to prevent corrosion and embrittlement.

Typical Milton Roy "Packaged" Systems for boiler water treatment are illustrated above. These systems are complete, include all necessary solution tanks, covers, gage glasses, low-level cutouts and alarms, motor starters and pumps as required. Automatic electronic controls can be supplied to operate pumps at speeds proportional to feed water flow as measured by flow meters. Systems are available to handle all treating chemicals and to meet all capacity and pressure requirements.

For complete information, ask for Bulletin 4811 and Technical Paper No. 51 "What the Power Engineer Needs to Know about Chemical Feed Systems."

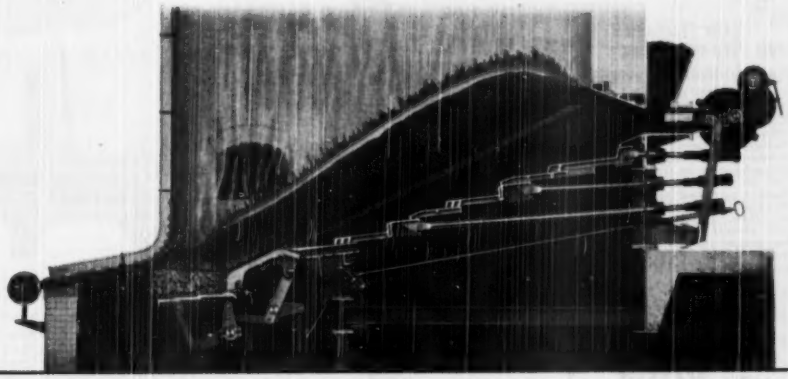
MILTON Roy COMPANY

1305 E. MERMAID AVE., CHESTNUT HILL, PHILA. 18, PA.

When you plan a power plant, remember . . .

TAYLOR STOKERS ELIMINATE STACK NUISANCE

AMERICAN ENGINEERING COMPANY



Over 90% of ash delivered to ashpit . . . balance can be handled without costly recovery equipment

YOU'LL MEET the most stringent municipal ordinances on stack discharge with Taylor Stokers – even at low ratings – when installed in properly designed furnaces having adequate grate area. And what's more, the smokeless operation of these stokers is clear evidence of efficient combustion. Elimination of fly ash collectors reduces draft losses and often makes induced draft fans unnecessary.

Taylor Stokers have a precision-control coal feeding mechanism and a unique continuous ash discharge which enable them to burn coals from Nebraska to the Atlantic, and Canadian, British and Continental coals as well. Importantly, too, they give you quick load response and operate with reserve in the fuel bed that will continue steam generation for considerable time in case of interruption to power or coal supply.

Taylor Stokers are designed for generating from 20,000 to 500,000 pounds of steam per hour. Ask your Consulting Engineer. And mail coupon right now for fact-filled booklet on the Taylor Stokers.

AE

AMERICAN ENGINEERING COMPANY

PHILADELPHIA 25, PENNA.

Other AE Products: Perfect Spread Stokers, Marine Deck Auxiliaries, Hele-Shaw and Hydramite Fluid Power, Lo-Hed Hoists, Car Shakers, Car Pullers

American Engineering Company
2400 Aramingo Avenue, Philadelphia 25, Pa.

Gentlemen: Send me a copy of booklet giving full information on Taylor Stokers.

Name ..... Title .....

Company .....

Address .....

City ..... Zone ..... State .....

AUTOMATIC REGULATION OF FUEL FEED

METERED AIR NEEDED FOR COMBUSTION

A CONSTANT DRAFT MAINTAINED IN THE COMBUSTION CHAMBER

CASH STANDARD FUEL FEED CONTROLLER . . .

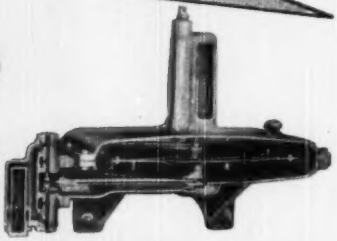
Automatically Regulates Fuel Feed

This CASH STANDARD Master Controller automatically regulates fuel feed. Locate it conveniently. Working from boiler pressure, it will adjust the rate of combustion by regulating the rate at which fuel (any kind of fuel) is supplied to the boiler furnace. And it will adjust the Air Flow Controller so the correct amount of air is supplied for proper combustion — hence, money saving.

CASH STANDARD AIR FLOW CONTROLLER

Meters the Air Needed for Combustion

This CASH STANDARD Air Flow Controller meters the air needed for combustion. Install it near its damper. It is not affected by changes in fuel bed resistance or any other variables, because it meters air supply according to the differential pressure through the gas passages of the boiler, doing its part to insure perfect combustion.



CASH STANDARD FURNACE DRAFT CONTROLLER

Maintains a Constant Draft in the Combustion Chamber

This CASH STANDARD Furnace Draft Controller (which comes complete with Operating Power Cylinder) works from overfire draft, regulating the boiler uptake damper to maintain a constant draft in the combustion chamber.

THERE'S YOUR *Answer* TO GREATER COST SAVINGS IN YOUR BOILER ROOM . . .

CASH STANDARD AUTOMATIC COMBUSTION CONTROL SYSTEMS

You get the cost savings three ways—(1) Less fuel—coal—oil—gas required. (2) Less maintenance requirements whether you have a single boiler or battery of boilers. (3) You get more steam from your present boiler.

The three units pictured are available in a number of variations. Combinations of these units selected in accordance with your specific requirements give you complete automatic control. Installation can be made on any type or size of boiler. It makes no difference whether you have a stoker, pulverizer, oil-burning or gas-firing equipment on your boilers.

Bulletin No. 300
shows applications—tells how the system works in your favor.

SEND FOR IT

Get the facts on the cost-saving Correct Fuel Feed—Correct Fuel Air Ratio—and Correct Over-Fire Draft. See how CASH STANDARD UNITS can be applied to your boiler whether you burn coal, oil, or gas—see why you get immediate and continuous economy in your boiler room.

A. W. CASH COMPANY
DECATUR, ILLINOIS

CASH STANDARD CONTROLS . . VALVES

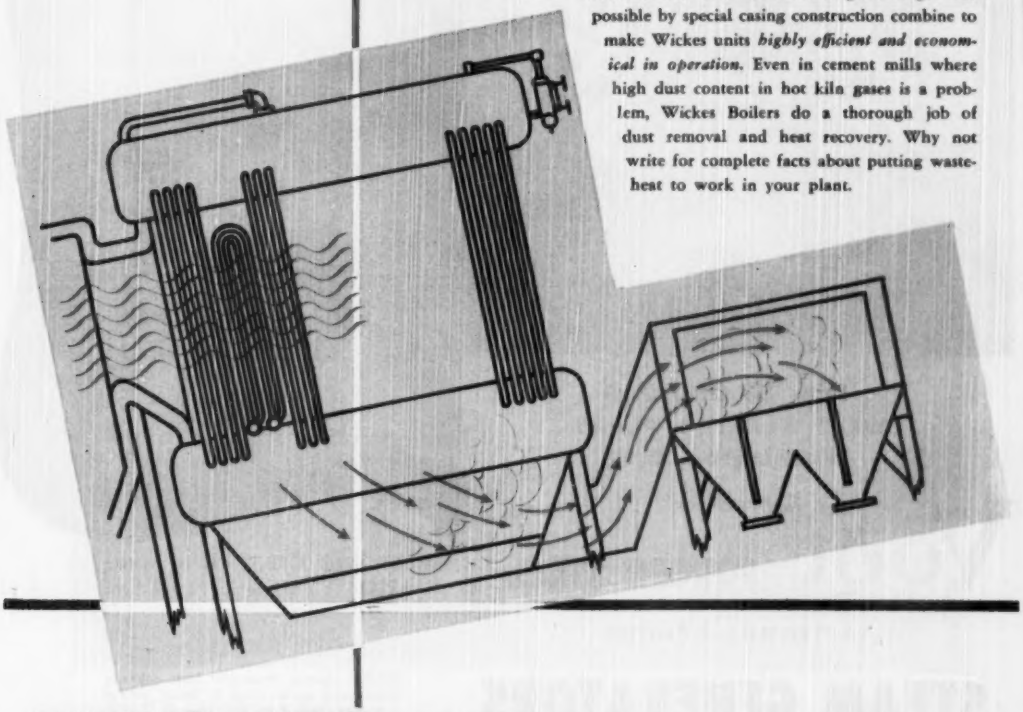
HARNESS WASTE HORSEPOWER WITH

WICKES WASTE-HEAT BOILERS

CONVERT WASTE-HEAT into PROFITABLE POWER

Waste heat, once discharged from manufacturing equipment as a loss, has been made to realize a high economic return through the installation of Wickes Waste-Heat Boilers. In actual cases, the reduction in the costs of manufactured products has *paid for the waste-heat installation* within 2-3 years time, and in some industries, heat recovery is sufficient to produce all steam and power required.

Wickes Boilers are correctly designed and built to effect maximum heat recovery from all types of waste gases. High gas velocity, long gas travel with minimum resistance and air-tight settings made possible by special casing construction combine to make Wickes units *highly efficient and economical in operation.* Even in cement mills where high dust content in hot kiln gases is a problem, Wickes Boilers do a thorough job of dust removal and heat recovery. Why not write for complete facts about putting waste-heat to work in your plant.



WICKES

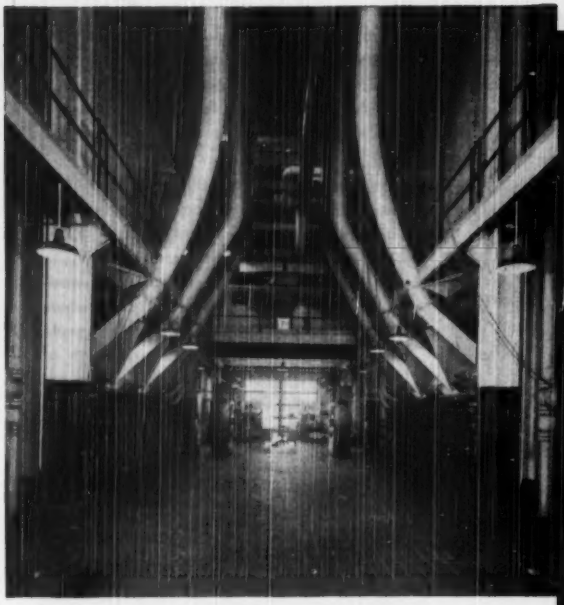
THE WICKES BOILER CO. • SAGINAW, MICHIGAN, U.S.A.
DIVISION OF THE WICKES CORPORATION

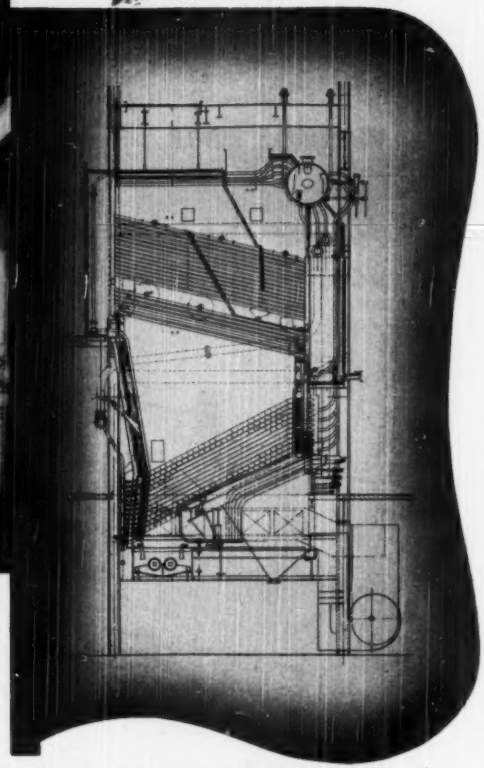
SALES OFFICES: Atlanta • Boston • Buenos Aires • Chicago • Cincinnati • Detroit • Havana • Houston Indianapolis • Los Angeles • Manila • Milwaukee • Mexico City • Montevideo • New York City • Pittsburgh Saginaw • San Francisco • San Jose, Calif. • San Juan • Seattle • Springfield, Ill. • St. Louis • Tulsa

RECOGNIZED QUALITY SINCE 1854

Federal Works Agency Photos

More Heat for the NATION'S CAPITAL





New $8,000,000
WEST HEATING PLANT
Washington, D. C.

Served By

Vogt FORGED STEEL SECTIONAL HEADER STEAM GENERATORS

ADDITIONAL ORDER NOW BEING FABRICATED FOR THIS PLANT

•

Principal Data, Each Unit

220,000 pounds steam per hour capacity Steam and water drum is fusion welded and designed for 400 pounds S.W.P. Sinuous forged steel tube headers. Water cooled furnace walls.

HENRY VOGT MACHINE CO.
Louisville 10, Kentucky

BRANCH OFFICES:
New York • Philadelphia • Cleveland
Chicago • St. Louis • Dallas

Where temperature control is a must

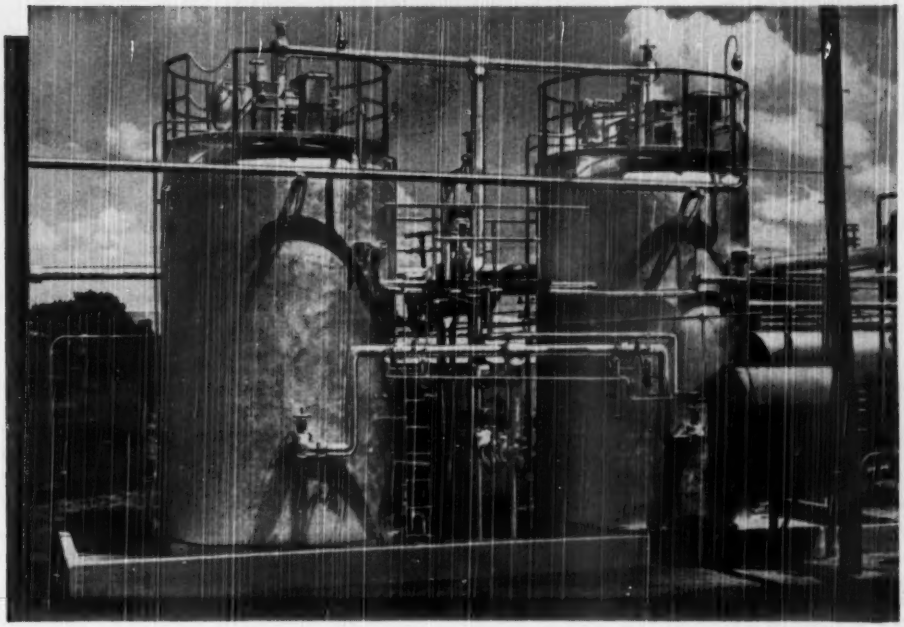
K&M "FEATHERWEIGHT" 85% MAGNESIA INSULATION

When your problem is complex . . . when you need the answer to accurate temperature control and high insulation value . . . you can depend on K&M "Featherweight" 85% Magnesia to take its full share of responsibility.

This dependable heat insulation assures high non-conductive efficiency that lasts. Its advantages come from the scientific K&M method of compounding clean asbestos fiber with basic carbonate of magnesia, in correct proportions—with proper distribution. The result is lightweight pipe and block insulation whose structural strength contributes to application and maintenance savings.

"Featherweight" 85% Magnesia, available in all standard dimensions, is one of the many types of insulation produced by K&M. Investigate them by obtaining full data and expert information from your nearest K&M Distributor.

Owner: Midland Cooperative Wholesale Refining Co., Cushing, Oklahoma.
Equipment: Desalters and Piping. *Contractor:* Armstrong Cork Co.
Insulation: K&M "Featherweight" 85% Magnesia—Weatherproofed.



Nature made Asbestos . . .
Keasbey & Mattison has made it serve mankind since 1873

KEASBEY & MATTISON
COMPANY • AMBLER • PENNSYLVANIA
In Canada — ATLAS ASBESTOS CO., LTD., MONTREAL, TORONTO, WINNIPEG and VANCOUVER

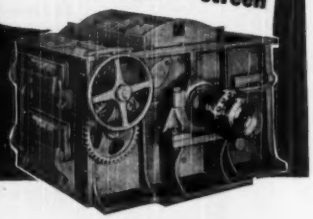
FOUR MILLION TONS OF COAL CRUSHED

with a parts replacement cost of only $.0005 per ton

AMERICAN AC3-E CRUSHER

in continuous service for 10 years

reduces 300 TPH 6" x 1¼" washed coal to 100% passing 1¼" screen



AT THE LITTLE SISTER COAL CORPORATION (St. David, Ill.)

. . . this crusher is giving a performance that is typically American—*typical* because American Crushers are engineered to "take it," and are *tested in actual use*. They slash power and labor costs too, and cut out-of-service time to a minimum. *Here are a few construction "whys" behind American records—*

THE HEAT TREATED ALLOY STEEL MAIN ROTOR SHAFT—revolves on heavy duty Timken Bearings enclosed in dust and oil-tight pillow blocks. *Perfect balance eliminates vibration.*

THE HEAVY RIBBED SECTIONAL FRAME—Cast Steel—permits *accessibility and adjustability* . . . bearing pedestals are cast integral with side frames to assure rigidity.

THE ALL-MANGANESE STEEL CRUSHING PARTS include renewable Breaker and Grinding Plate, also Crushing Chamber cheek liners. Grinding Plate is adjustable to compensate for long wear.

REVERSIBLE SHREDDER RINGS

In reducing coal by *controlled cleavage* (instead of by crushing), these 20-edge manganese steel rings give uniform, high tonnage reduction, with a minimum of degradation, operating at slow (275 to 350 RPM) power-saving speeds.

Let an American representative analyze your crushing problem. Also, we'll be happy to send you our bulletin "Crushing Coal at Less than One Cent Per Ton."

American PULVERIZER COMPANY

Originators and Manufacturers of Ring Crushers and Pulverizers

1349 MACKLIND AVE.
ST. LOUIS 10, MO.

The Reliance Safety Team

Warns you of low or high boiler water

Prevents many a water level accident

SOUND CHECK ✓ **ALARM Water Column**

SIGHT CHECK ✓ **EYE-HYE Remote Gage**

This team works for thousands of plants like yours. It double checks boiler water levels—helps you achieve more efficient operation, lower power cost, greater safety. The sensitive float-operated mechanism in the Alarm Water Column sounds a last-resort warning (see whistle) when water approaches low or high danger points. But for minute-by-minute scanning by operators, EYE-HYE beams its bright picture of true water level condition from a convenient eye-level position. It's the original remote reading gage—all-hydrostatic, simple, sure. It pays you to have the Reliance Safety Team for adequate boiler water level supervision. Write for details—or ask your Reliance Representative.

The Reliance Gauge Column Company • 5902 Carnegie Ave., Cleveland 3, Ohio

Reliance Boiler Safety Devices since 1884

What makes the difference in Unit Heaters?

DISCHARGE AIR TEMPERATURE*

Mibs shooter or stilt walker — you're comfortable either way if Modine Unit Heaters supply the heat. Modine's *right* combination of correct outlet temperature and sufficient air velocity heats all parts of a room uniformly, even in coldest weather.

You'll find just the unit heater you need from Modine's complete line of 3 types and 47 capacities.

**For maximum comfort and lowest operating cost, temperature of air leaving unit heater should be between 110°-120°F. at standard conditions.*

LOWER COSTS

Fuel bills drop when you heat with Modine Unit Heaters. Modine's sufficient air velocity and correctly related outlet temperatures combine to deliver heat down into comfort zones where it's needed . . . don't waste it on ceilings or above heads of room occupants.

Built-in velocity generator increases heat throw *without increasing power costs* . . . lets large share of warm outlet air disperse cold air near floor.

Modine gives you lower power and motor maintenance costs, too, by using only high-quality, totally enclosed split-phase or capacitor motors on all but smallest unit heater models.

LONGER LIFE

Modine Unit Heaters last longer. One exclusive feature, Parker-Bonderizing, protects casings and sheet metal parts against formation and spread of rust . . . anchors paint to steel . . . prolongs original attractive finish.

Entire condenser of pure copper and copper alloy gives you maximum resistance to electrolysis and corrosion.

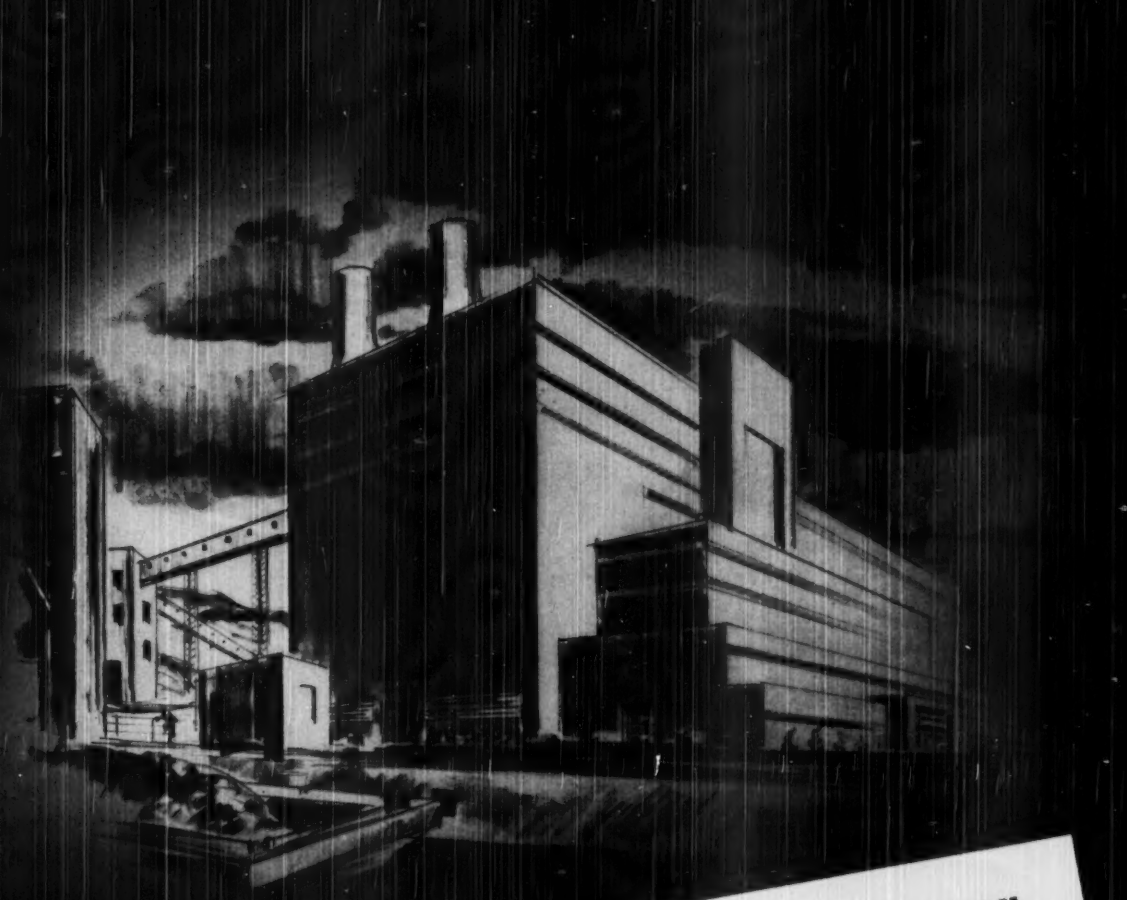
Controlled brazing results in one-piece, integrated coil construction, eliminating all weak spots. What's more, Modines have no screwed or expanded joints, no gaskets or bolts.

Modine
UNIT HEATERS

Yes . . . look beyond BTUs when buying Unit Heaters. Look to Modine! You can get all the facts by calling your nearest Modine Representative. He's listed in the classified section of your phone book. Or write direct. Modine Mfg. Co., 1512 Dekoven Ave., Racine, Wisconsin.

Ask for the new Modine Unit Heater Bulletin 149-A. Also available on special request is the informative booklet — "Here's How to Evaluate Operating Characteristics of Suspended Unit Heaters." Send for them today!

U-1043



DUQUESNE LIGHT COMPANY'S new Elrama power plant, near Pittsburgh, now under construction by Dravo, will increase Duquesne's system capacity by almost 25%. Dravo will serve as construction agent for the entire project, including a coal unloading dock, a mechanized coal-handling system, outdoor switching facilities and a screen house. This is the third large-scale power project entrusted to Dravo by Duquesne Light within the past two years.

DRAVO CORPORATION

POWER DEPARTMENT

Let us be your Construction Department

ENGINEERING CONSTRUCTORS

DRAVO

CORPORATION

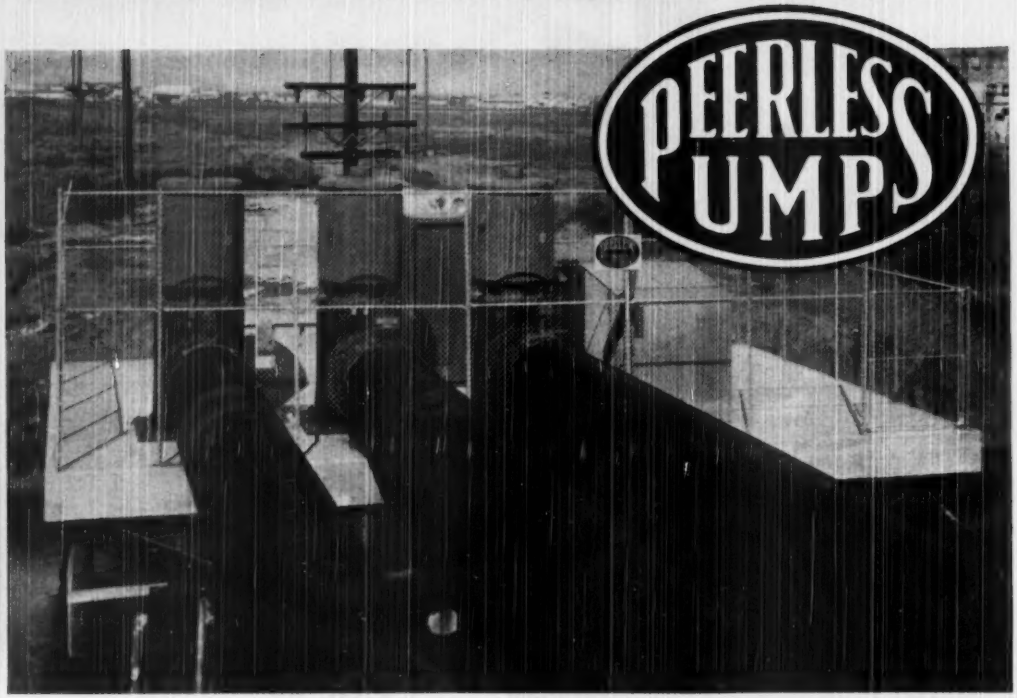
DRAVO BUILDING, PITTSBURGH 22, PA.

Engineering constructors of power plants, boiler plants, central stations, compressor stations, water pumping stations. Fabricators and erectors of power piping. Machinery installation. Power and boiler plant equipment.

PITTSBURGH · PHILADELPHIA · CLEVELAND · NEW YORK · DETROIT

DRAVO

PEERLESS IN THE WORLD OF MOVING AND CONTROLLING WATER IN LARGE VOLUMES



PEERLESS HYDRO-FOIL PUMPS

OFFER CAPACITIES RANGING UP TO 220,000 G.P.M. AGAINST LOW AND MEDIUM HEADS FROM 2 TO 60 FEET

MIXED FLOW AND PROPELLER TYPES—The best way to move large quantities of water against low or moderate heads is to use Peerless Hydro-Foil Pumps. They're available in two types: propeller type and mixed flow type. Advanced principles of hydro-dynamics applied to the design of these versatile pumps insures lower overall maintenance outlay and reduced pumping costs, in all applications.

SINGLE AND MULTI-STAGE MIXED FLOW PUMPS—Peerless mixed flow pumps are made in single or multi-stage units to give flexibility in the selection of each pumping unit. These pumps complement the propeller type and embody advantageous characteristics of both axial-flow and centrifugal pumps. Designed for sump applications with minimum submergence, maximum heads, minimum installation space. Also available in close-coupled types.

ALL TYPES OF DRIVES—Any type of drive may be used with Peerless Hydro-Foil Pumps. These include: electric motor, right angle gear drive, V-belt and flat belt or a combination of drives, if required.

REQUEST 24-PAGE BULLETIN—For complete design, construction and application data including suggested station arrangements of these Peerless Hydro-Foil Pumps for economical, large-volume water pumping, request Bulletin B-148-1 now.

A FEW OF THE SERVICES AND APPLICATIONS OF THESE MULTI-PURPOSE PUMPS

- DRAINAGE
- FLOOD CONTROL
- CANAL DIVERSION
- DE-WATERING
- INDUSTRIAL AND PROCESSING APPLICATIONS
- CONDENSER COOLING
- IRRIGATION
- STORM WATER REMOVAL
- SEWAGE AND EFFLUENT REMOVAL

PEERLESS PUMP DIVISION
FOOD MACHINERY AND CHEMICAL CORPORATION
Factories: Los Angeles, California, and Indianapolis, Indiana
Offices: New York, Atlanta, Fresno, Los Angeles, Chicago, St. Louis, Phoenix; Dallas, Plainview and Lubbock, Texas.

Now... Yoloy Pipe

CONTINUOUS WELD

for use where corrosion is a problem

FOR fifteen years, Yoloy steel has been manufactured as Seamless pipe, sheets, plates and structural members. Yoloy is used in the oil, mining, railroad, chemical, trucking and other industries where resistance to corrosion and abrasion are a problem and lighter weight construction is important. Now this same unique nickel-copper low-alloy steel is available as continuous weld pipe.

Yoloy continuous weld pipe has these outstanding characteristics:

1. It is easy to weld,
2. It bends and fabricates readily,
3. Its tensile strength is high,
4. It is resistant to abrasion,
5. Its resistance to shock and vibration is high,
6. It is high in corrosion resistance.

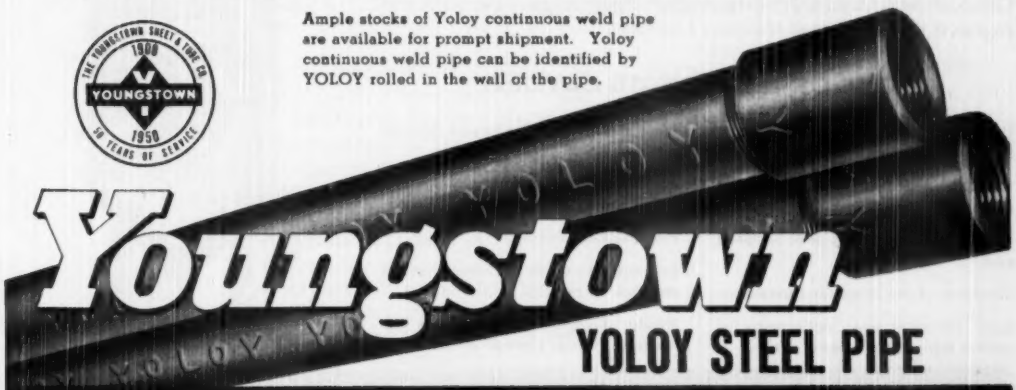
Yoloy has an atmospheric corrosion resistance from four to six times that of regular carbon steels. Its resistance to many other corrosive elements likewise is high, making Yoloy pipe particularly well adapted for use in the railroad, oil, mining and chemical process industries. Youngstown Yoloy continuous weld pipe also affords distinct advantages for use where piping is concealed in industrial plants, commercial buildings and residences.

For example, at a sewage plant, Yoloy pipe immersed in the sour sludge of a digester was found to be in good condition after nearly four years. When repairs were made to replace a mild steel tripod holding the pipe after only one year's service, it was found that the tripod had been almost entirely eaten up by the acid sludge.

Yoloy continuous weld pipe installed in brine lines from the wells at a salt plant is still in service after several years. Pipe previously used in this same line had to be replaced 3 or 4 times a year.

Other examples of the unusual service given by Yoloy pipe can be cited. For further information, write or phone the Youngstown District Sales Office nearest you.

Ample stocks of Yoloy continuous weld pipe are available for prompt shipment. Yoloy continuous weld pipe can be identified by YOLOY rolled in the wall of the pipe.



Youngstown

YOLOY STEEL PIPE

THE YOUNGSTOWN SHEET AND TUBE COMPANY

Manufacturers of Carbon, Alloy and Yoloy Steel

General Offices — Youngstown 1, Ohio

Export Office - 500 Fifth Avenue, New York

PIPE AND TUBULAR PRODUCTS · CONDUIT · BARS · RODS · COLD FINISHED CARBON AND ALLOY BARS
SHEETS · PLATES · WIRE · ELECTROLYTIC TIN PLATE · COKE TIN PLATE · RAILROAD TRACK SPIKES

NEW

Latest Developments in HOT-PROCESS SOFTENERS

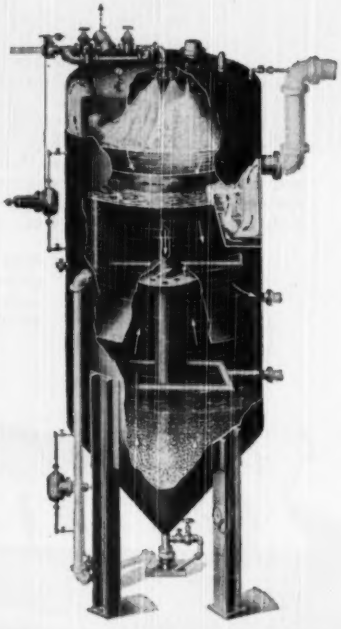
Described in this 36-page bulletin

Here is a bulletin that should be read by every plant executive and engineer with boiler feed problems.

It is *authoritative* because it is prepared by the engineers and chemists of an organization with more than *40 years of experience* in the field of hot process treatment and general boiler feedwater treatment.

It is *informative* because it clearly shows the practical applications of the scientific principles involved in modern, efficient hot process softener designs.

Copies of the bulletin will be sent without charge to plant executives and engineers writing on their Company letterhead.



SOME OF THE SUBJECTS COVERED

Operating problems requiring boiler feedwater treatment

The 12 principal methods of feedwater treatment

Why the hot-process treatment is widely used

Chemistry of the hot-process treatment

Basic principles and requirements of modern hot-process softener design

How a GRAVER Hot-Process Softener operates

16 Designs of modern hot-process softeners and where each should be used

Hot Zeolite Softening

Latest developments in chemical feeders and their accessories

Results obtained from hot-process softeners in various types of installations

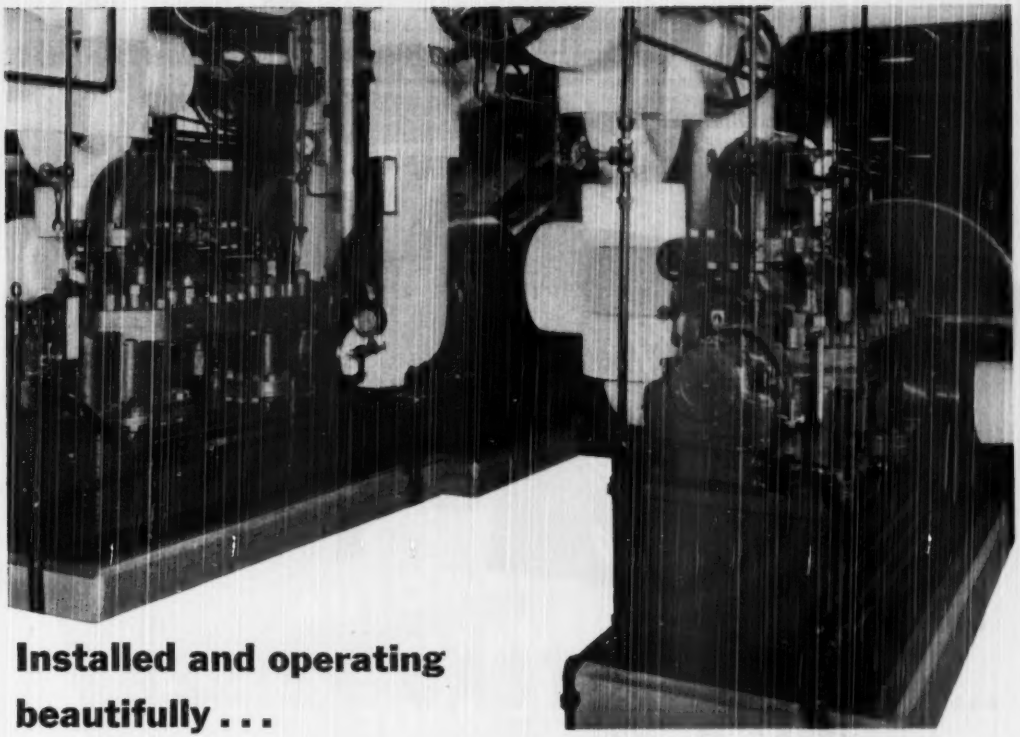
GW 420

GRAVER

GRAVER WATER CONDITIONING CO.

Dept. 103, 216 West 14th Street, New York 11, New York, U.S.A.

A DIVISION OF GRAVER TANK & MFG. CO. INC. EAST CHICAGO, IND.



Installed and operating beautifully . . .

TWO WARREN *Big Boys*

FOR CENTRAL MAINE POWER COMPANY

CENTRAL Maine Power Company has had many years of successful experience with Warren Pumps. Among the recent installations are two Type TH high pressure pumps at their enlarged Mason Steam Plant, Wiscasset, Maine. They are operating at capacities of 325 and 550 g.p.m. against a pressure of 900 p.s.i.g. These pumps are also available with a capacity up to 850 g.p.m. and a pressure range up to 1200 p.s.i.g. • Every construction and material feature of these Warren Pumps contribute to the highest dependability and efficiency, long life and low maintenance, with special emphasis on safety. They will prove a sound investment over the years, as numerous other Warren Pumps have in this and many other central power stations, industrial plants, municipal and Federal projects.

Write for Bulletins 241 and 244 giving complete details on Warren Pumps for higher pressure services. P-48

WARREN PUMPS

WARREN STEAM PUMP COMPANY, INC., WARREN MASSACHUSETTS

...Use HOMESTEAD-REISER

FULL PORT *Self-Seald* LUBRICATED PLUG VALVES

. . . the Lowest Priced, Full-Port-Area Plug Valves In Their Rated Working Class

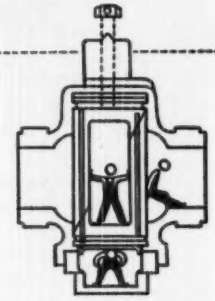
If you're using a venturi (restricted-port-area) valve with an opening of say, 60% standard pipe area, you are operating at reduced line pressure. To be sure of nearly full line pressure, you must use a larger size venturi, which of course means a higher priced valve . . . perhaps as much as 30% higher!

For example: A 2½" Homestead-Reiser has a 100% full-port-area, or 4.78 sq. in. The 2½" size in 60% venturi pattern has only 2.87 sq. in. port area. To approximate the full-port-area of a 2½" Homestead-Reiser valve, a 3" venturi must be used. And even then you'll have less than Homestead-Reiser's full-port-area.

In the light of this evidence doesn't it stand to reason that Homestead-Reisers with their 100% full-port-area are sound economy?

Truly, from the standpoint of both first cost and length of service, they are the lowest priced, full-port-area lubricated plug valves in their rated working class!

←For complete information, write for Catalog 39, Section 5. We'll mail it to you promptly.



"SELF-SEALD" MEANS

. . . that in addition to a full-port lubricant seal the wedge-action of the plug under line pressure, forces the finished surfaces of the plug outward and constantly presses them against the seating surfaces of the body, thus keeping them always in intimate contact. The plug automatically adjusts itself for wear, assuring extra long life, maximum leakless service and lubricant economy.

HOMESTEAD VALVE MANUFACTURING CO.

"Serving Since 1892"

P.O. Box 210 **Coraopolis, Pa.**

An actual user benefit provided by

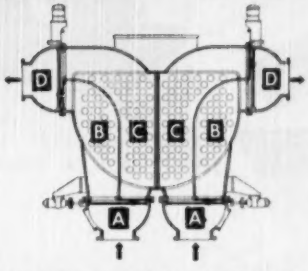
Wheeler's skill in engineering

REVERSE-FLOW CONDENSERS

Loss in operating time and the cost of periodic cleaning has been eliminated by using C. H. Wheeler's reverse-flow condenser. The reverse-flow condenser automatically cleans its own tubes and tube sheets periodically with no pause in operating efficiency. And the reversal of water flow is done almost instantly, merely at the touch of a button.

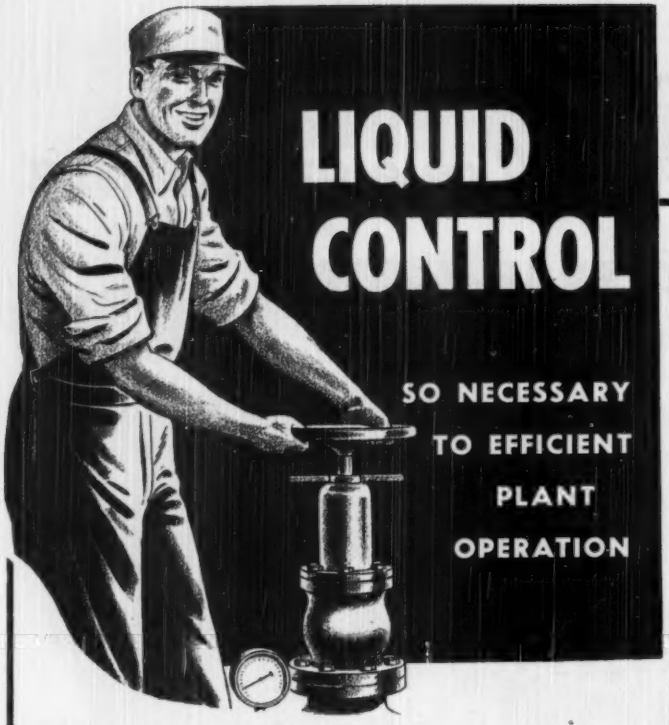
While your installation may not require a reverse-flow condenser, it is just one example of Wheeler's skill in engineering. With over fifty years experience in the power field—and, with usually more than a quarter-million square feet of condensers on the production lines—it is inevitable that Wheeler leads in condenser design.

When you have any heat transfer or vacuum problem, you can count on the right answer from skilled, experienced engineers . . . from C. H. Wheeler Mfg. Co., 1800 Sedgley Ave., Philadelphia 32, Pa.



In the operation of a C. H. W. "Reverse-Flow" Condenser, with divided water box, water enters valve chamber at A with left hand valve port open to permit water to flow through pass B, then changing direction at other end of condenser and flowing back through pass C and out through the upper port of D. To reverse flow, valves at inlet A and discharge D are changed to permit water to flow through C first, returning through B and out through the lower port of D. Both halves of the condenser are operated in similar manner, but independently of each other.

C.H. Wheeler OF PHILADELPHIA | STEAM CONDENSERS • WATER COOLING TOWERS EJECTORS • STEAM JET VACUUM REFRIGERATION



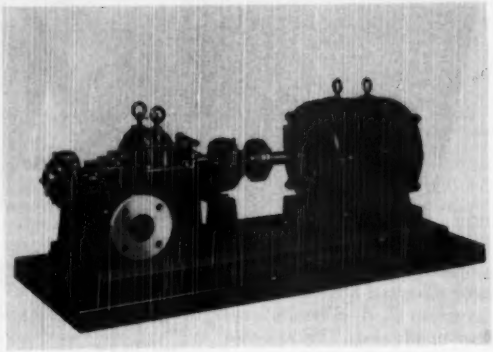
LIQUID CONTROL

SO NECESSARY TO EFFICIENT PLANT OPERATION

BE *Sure* OF IT— SPECIFY "Buffalo" PUMPS

Getting your liquids where you want them in the right volumes at all times—*liquid control*—must be backed up by DEPENDABLE PUMPS! "Buffalo" pumps have a reputation throughout industry for this kind of service. Extra heavy construction in every part—plus efficient design — are the reasons. DON'T LEAVE *YOUR* LIQUID CONTROL TO CHANCE.

Write for Bulletins 955-N and 980-B for helpful facts on any service you need.



"BUFFALO" CLASS "RR" PUMP FOR BOILER FEED SERVICE—in 20 to 900 gpm. capacities for heads up to 1500 ft.

"Buffalo" PUMPS

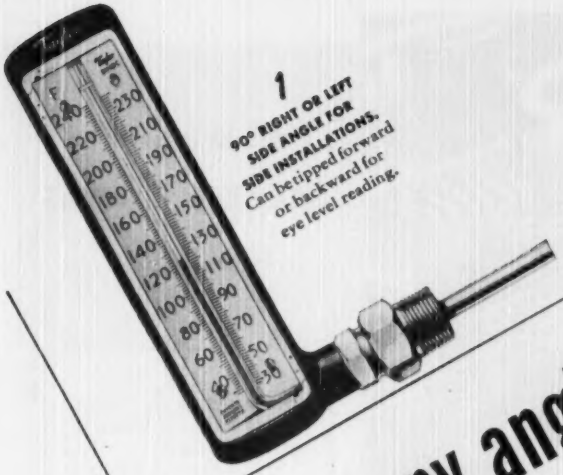
BUFFALO PUMPS INC.

488 BROADWAY BUFFALO, NEW YORK

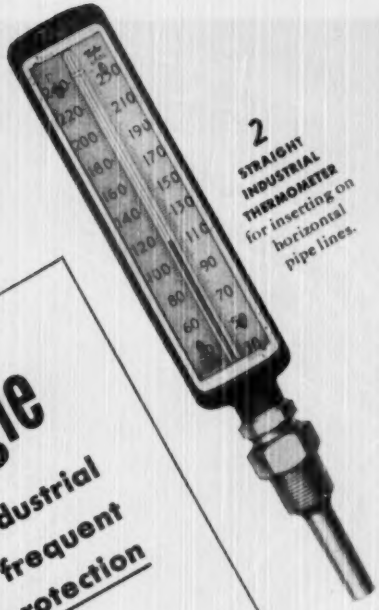
Canada Pumps Ltd., Kitchener, Ont.

Branch Offices in All Principal Cities

A BETTER CENTRIFUGAL PUMP FOR EVERY LIQUID



1 **90° RIGHT OR LEFT SIDE ANGLE FOR SIDE INSTALLATIONS.** Can be tipped forward or backward for eye level reading.



2 **STRAIGHT INDUSTRIAL THERMOMETER** for inserting on horizontal pipe lines.

From any angle

Easy-Reading Taylor Industrial Thermometers invite frequent readings for better protection of your equipment.

1 **Exclusive,** three-times-easier-to-read Binoc* tube actually invites *frequent* reading.

2 **Extra-bold** black numerals stand out sharply on white background.

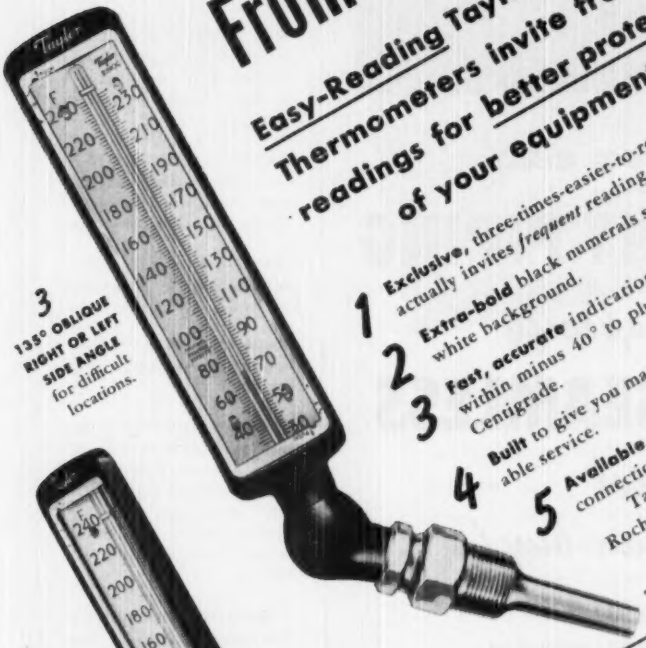
3 **Fast, accurate** indications of all temperatures within minus 40° to plus 950°F., or equivalent Centigrade.

4 **Built** to give you many years of rugged, dependable service.

5 **Available** with a wide variety of stems and connections. Write for CATALOG E today!

Taylor Instrument Companies,
Rochester, N.Y., and Toronto, Canada.

*Registered Trade-Mark

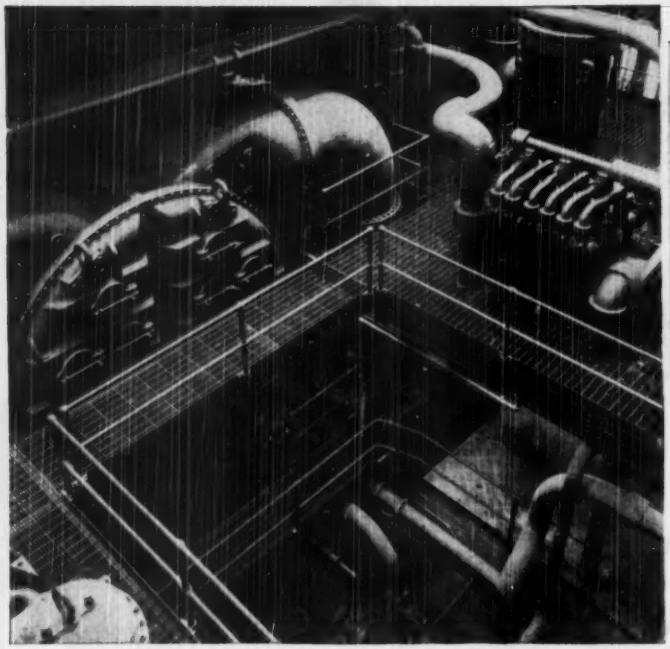


3 **135° OBLIQUE RIGHT OR LEFT SIDE ANGLE** for difficult locations.

4 **90° ANGLE INDUSTRIAL THERMOMETER** for vertical pipe lines.

Taylor Instruments
MEAN
ACCURACY FIRST
IN HOME AND INDUSTRY

Instruments for indicating, recording and controlling temperature, pressure, humidity, flow and liquid level.



Here's what NATIONAL SEAMLESS offers you . . .

STRENGTH. Ultimate strength from 45,000 p.s.i. to 95,000 p.s.i. or more as required.

DUCTILITY. Meets requirements for flanging, bending, expanding, coiling, and similar purposes.

CREEP STRENGTH. Available in various grades of steel to assure a minimum of creep regardless of the temperatures encountered.

CORROSION RESISTANCE. Various grades of steel from plain carbon to U·S·S Stainless according to service requirements.

HEAT RESISTANCE. Various heat-resisting alloys for higher temperatures and special conditions.

WELDABILITY. Readily weldable with the proper types of welding rods.

UNIFORM WALL STRENGTH. The piercing of a solid billet of steel to form seamless pipe stands alone among all processes of pipe making as the one method that absolutely removes all uncertainty regarding uniform wall strength.

• Write for Bulletin No. 10, "Power Plant Piping" to National Tube Company, Frick Bldg., Pittsburgh 19, Pennsylvania.

Whenever you need

POWER PLANT PIPING

play safe, specify

NATIONAL SEAMLESS

the finest that money can buy!

NATIONAL TUBE COMPANY, PITTSBURGH, PA.

COLUMBIA STEEL COMPANY, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS

UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS

NATIONAL *Seamless*

POWER PLANT PIPING

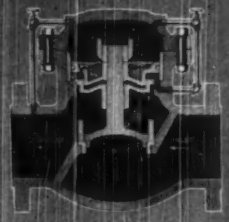
UNITED STATES STEEL

DEPENDABILITY

proven in

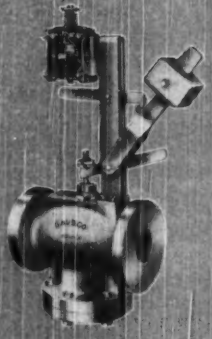
Power Plants

Everywhere



G-A Hydraulic Double Cushioned Check Valve, Globe Pattern.

G-A Double Cushioned Check Valve, Globe Pattern.



G-A Electric Trip Double Cushioned Check Valve, Globe Pattern.

HYDRAULIC
AUTOMATIC MANUAL
GOLDEN-ANDERSON
positive control
check valves

You will find Golden-Anderson "Positive Control" Check Valves *providing economical protection for valuable equipment* in America's largest Power Plants. Balanced Check Valves prevent reversing of pump and motor by closing instantly before reverse flow occurs. Double Cushioning feature eliminates serious surge and "water hammer" on emergency shut-down of pumps.

Write for the newest technical data on Power Plant Valves.

GA

GOLDEN-ANDERSON *Valve* Specialty Company

LIFE AND PROPERTY PROTECTION
VALVES SINCE 1905

Keenan Building, Pittsburgh 22, Pa.

WHY DISRUPT

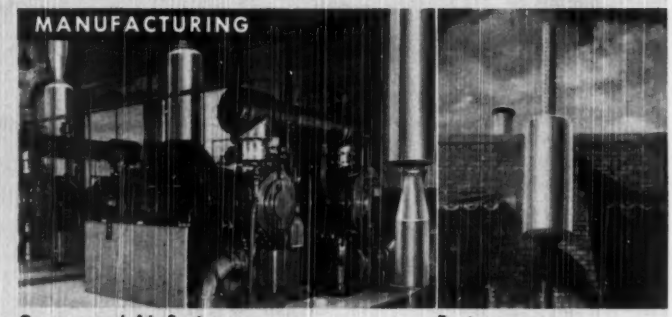
Quiet Surroundings

with Noisy Engines and Compressors?

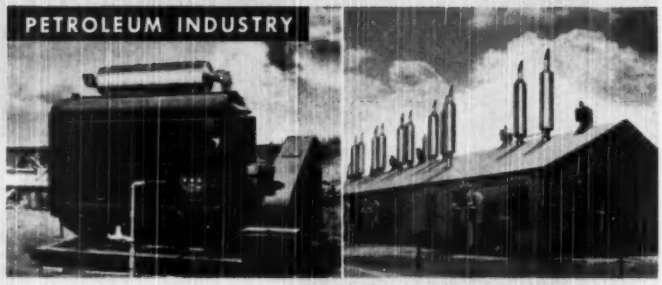
Wherever noise from internal combustion engines, compressors, blowers, vacuum pumps cannot be tolerated, or where flying sparks must be eliminated, America's leading industrial organizations are selecting Burgess-Manning equipment. Snubbers can also be used to control gas surging and the harmful vibration of machinery and piping produced by such pulsations. Noise is prevented by the Snubber which dissipates the energy in the exhaust gas slugs and smooths the flow of intake air . . . providing quiet operation without affecting performance.

If you are installing internal combustion engines or compressors, or if you have exhaust or intake noise complaints, let Burgess-Manning submit Snubber recommendations. Long experience guarantees complete satisfaction.

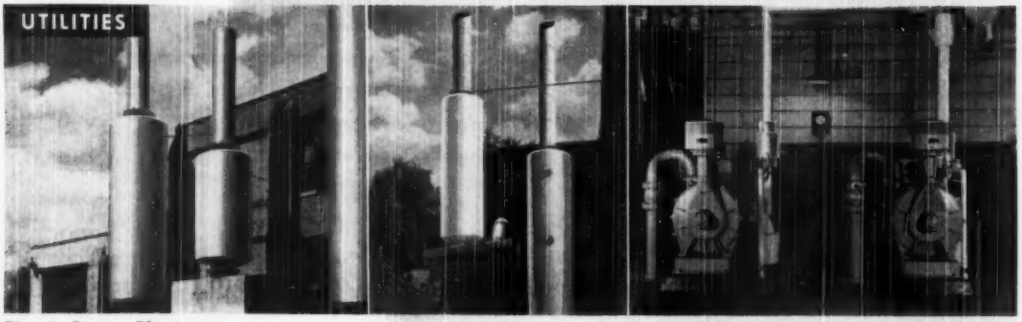
Snub the Slug— and Stop the Noise



Compressed Air System — Factory

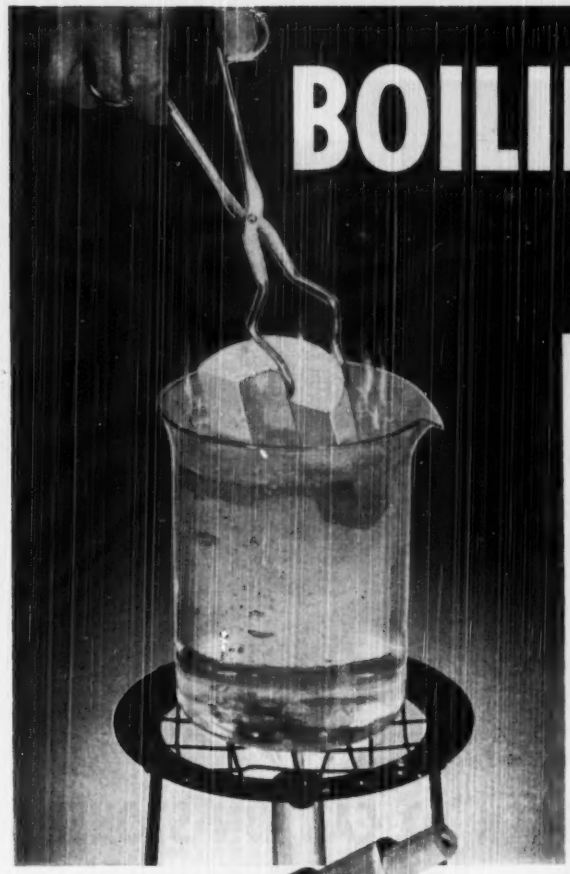


Pipe Line Engine — Compressor Station



Electric Power Plant — Electric Power Plant — Municipal Water Plant

BURGESS-MANNING COMPANY
LIBERTYVILLE, ILLINOIS



BOILING TEST

PROVES STABILITY OF KAYLO HEAT INSULATION

What insulation material will not break down under exposure to live steam or hot liquid? Answer: Kaylo Heat Insulation.

In tests, samples of Kaylo Heat Insulation have been boiled continuously for 24 hours and longer. None has disintegrated or shown any loss of insulating efficiency, after drying. Test boiling has caused no appreciable shrinking, swelling, weight loss or permanent change in Kaylo Heat Insulation.

This Inorganic Material Insulates Efficiently From 200° F. to 1200° F.

One layer of Kaylo Heat Insulation assures you of insulating efficiency from 200°F. to 1200°F.—a temperature range which often requires two thicknesses of different materials . . . and the efficiency of Kaylo insulation actually improves after exposure to service temperatures.

This remarkable new product is available in two forms: Kaylo Heat Insulating Block and Kaylo Pipe Covering. Both are exceptionally strong, lightweight and resistant to moisture damage . . . easy to handle and apply . . . neat and clean in appearance on finished jobs.

The many advantages offered by Kaylo Heat Insulation are appreciated by users in many different industries.

KAYLO PIPE INSULATION is produced in Simplified Dimensional Standards of thicknesses and diameters for snug nesting, when necessary. Available in thicknesses from 1 to 3 inches in 36-in. sections, for pipe sizes from ½ to 12 in.

KAYLO®

HEAT INSULATING BLOCK and PIPE COVERING

OWENS-ILLINOIS GLASS COMPANY
Kaylo Division • Toledo 1, Ohio

SALES OFFICES:
Atlanta • Boston • Buffalo • Chicago • Cincinnati • Dallas • Minneapolis
New York • Philadelphia • Pittsburgh • St. Louis • Toledo • Washington

SEND COUPON FOR KAYLO HEAT INSULATION SAMPLE & LITERATURE

OWENS-ILLINOIS GLASS COMPANY
Dept. N-72, Kaylo Division · Toledo 1, Ohio

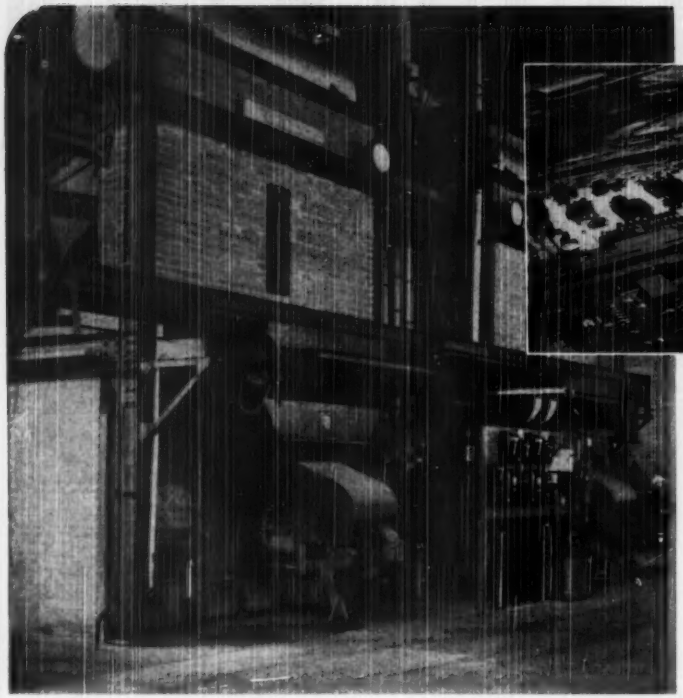
Gentlemen: Please send me a Kaylo Heat Insulation sample and descriptive literature.

NAME.....

FIRM.....

ADDRESS.....

CITY.....STATE.....



THE EUCLID ROAD MACHINERY COMPANY, one of the foremost manufacturers of heavy equipment for moving earth, rock, coal and ore

TRIES OIL—SWITCHES BACK TO CANTON STOKERS

for Economy and Better Power Service . . .

When The Euclid Road Machinery Company built its modern Chardon Road plant in Cleveland, Ohio, two Canton Stokers were installed to fire the boilers of the power plant.

Later, one of the stokers was replaced by an oil burner but costs were too high and results not always satisfactory. Accordingly, when a new power plant was designed for greater economy and better results, Canton Stokers were placed back on the job.

Like hundreds of users of Canton Stokers for power and heating, Euclid finds by experience that Canton-Stoker-fired coal is the most economical and flexible fuel to meet the fluctuating demands of power and heating service. Moreover, Canton Stoker users enjoy the advantages of long, trouble-free service with almost negligible maintenance. Canton Stokers are so ruggedly built that *the driving mechanism is guaranteed for five years.*

Canton Stoker Field Sales Engineers will be pleased to help you find the economical answer to your power and heating problems — without obligation, of course. Write, phone or wire Canton Stoker Corporation, 741 Andrew Place S. W., Canton 1, Ohio.

CANADIAN LICENSEES: VOLCANO, LTD., MONTREAL, QUE.

CANTON STOKERS

DURAFLEX WORMFEED
for loads up to 175 H.P.

LO-SET RAMFEED
for loads up to 350 H.P.

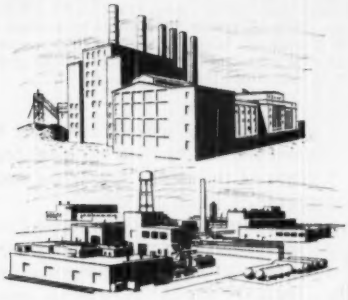
VULCAN RAMFEED
for loads up to 800 H.P.

Also

SYNCHRONIZED COMBUSTION CONTROL SYSTEMS
for all boilers

TURBO-AIRE JETS
for smoke abatement, firing efficiency

They're investing millions where mining *pays!*



→ In the Bituminous lands of the B&O, progress never stops. Year after year, enterprising coal producers back their faith in B&O coals with new mines and processing plants, with increased mechanization and up-to-the-minute equipment.

B&O Bituminous lends itself to modern, low-cost mining. Because of its nearness to America's industrial heart, transportation costs are moderate. Markets are dependable, and there is a wide variety of coals to meet all needs.

Smart consumers "bank on B&O Bituminous"—its sources and reserves are known and great.

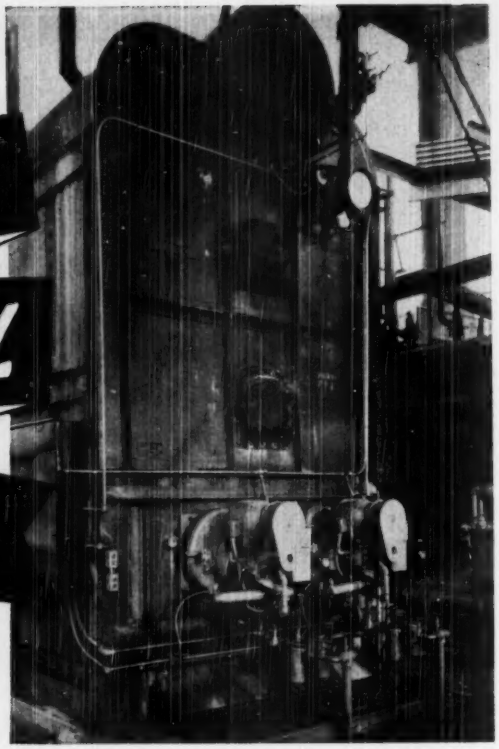
Ask our man!

BITUMINOUS COALS FOR EVERY PURPOSE

BALTIMORE & OHIO RAILROAD

Constantly *doing things*—better!

BURN ECONOMICAL HEAVY OIL



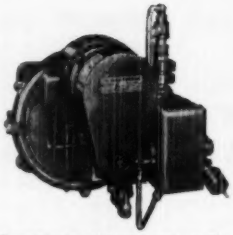
Two Iron Fireman oil burners firing Erie City VL 350 h.p. boiler at 160 p.s.i., 200% of rating. Deodorizes by-product gases in combustion chamber of boiler, in addition to generating steam. Fuel is high acid petroleum, by-product of asphalt production; consistency of fuel varies from No. 1 to No. 6.

with the highly efficient IRON FIREMAN Industrial Oil Burner

Now you can use economical heavy oils (Nos. 5 and 6) with the Iron Fireman Industrial Oil Burner and get a steady, even flame, regardless of varying oil temperature or viscosity. This steady flame starts more smoothly and it *stays* steady, even at very low burning rates.

New Principle of Oil Control

Iron Fireman's exclusive Oil Volumeter employs a new principle of oil control which eliminates the inefficient combustion and many troubles that go with conventional controls. Oil flow control with the Oil Volumeter is positive and precise because the oil feed-rate is regulated by *volume*, instead of using complex mechanisms (as some burners do) to change the size of the opening through which oil flows.



Capacities 2 to 165 gals. per hour. Fires boilers up to 550 h.p. per burner. Positive *volume* control insures steady flame regardless of oil temperature or viscosity.

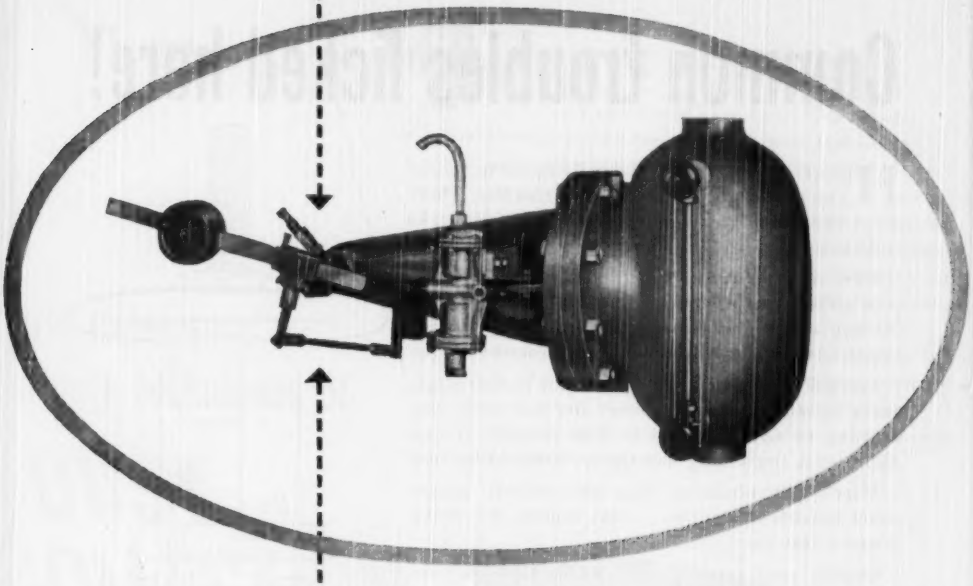
The result of the Oil Volumeter's exact control is steady, non-pulsating combustion, enabling the Iron Fireman Industrial Oil Burner to make an enviable record of fuel and labor savings throughout the United States and Canada.

Write to find out how an Iron Fireman Industrial Oil Burner can reduce your fuel and labor costs. Iron Fireman Manufacturing Co., 3233 W. 106th Street, Cleveland 11, Ohio. Other plants in Portland, Oregon, and Toronto, Canada.

IRON FIREMAN

INDUSTRIAL OIL BURNER

INSTALL IT AND FORGET IT!



For Economical and Dependable Liquid Level Control

...THE HONEYWELL FLOAT CAGE

USER reports show up to ten years of accurate, dependable service . . . on surge tanks, feedwater heaters, evaporators, deaerating tanks, stills and other process equipment! This eliminates one troublesome maintenance problem . . . and, at the same time, assures the continuity of service that leads to greater processing efficiency.

Honeywell Float Cages are supplied either with direct connection for mechanical operation, or with on-off or throttling type pilot valve for pneumatic operation. In addition, the Honeywell line includes internal float type level controllers for use where vessel design and conditions permit.

Honeywell Float Cages are available in Bronze, Cast Iron, or Cast Steel . . . with Bronze, Stainless Steel or Special Alloy trim. Float sizes—6", 8" and 10".

Call in your local Honeywell engineer for detailed information about these float cages and such other Honeywell Control Specialties as Hi-Lift Hand Control Valves, Non-Lubricated Cylindrical Plug Valves, Transfer Valves, and the Honeywell Space-Saving Bypass.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, 1900 Windrim Avenue, Philadelphia 44, Pa. Offices in more than 80 principal cities of the United States, Canada and throughout the world.

COMMERCIAL • RESIDENTIAL • INDUSTRIAL
WORLD'S LARGEST ORGANIZATION FOR ADVANCED INSTRUMENTATION AND CONTROL

Honeywell
VALVE PRODUCTS

Common troubles licked here!

HERE is a Darling Gate Valve designed to relieve you of the most common valve troubles. There are a number of contributing features, but let's take only two . . .

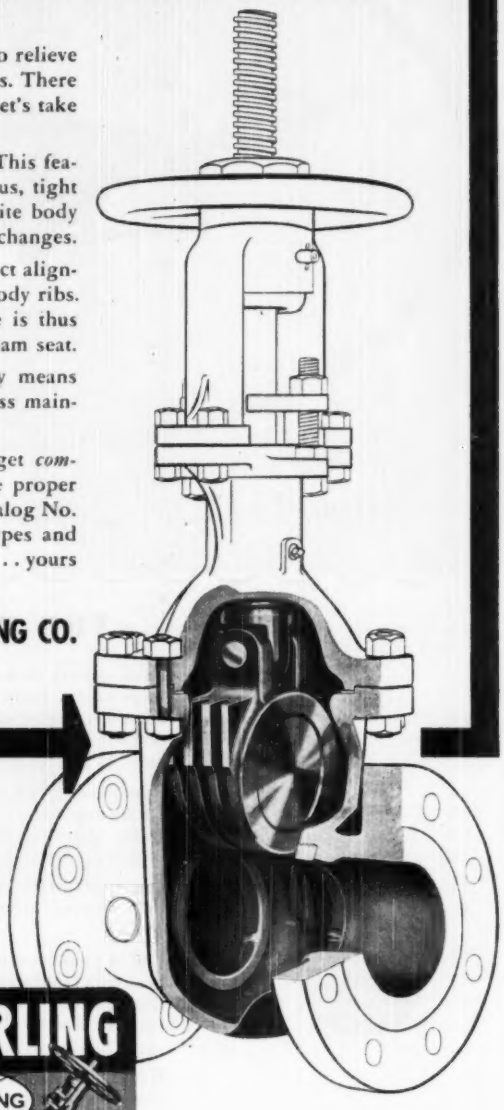
First, note the center slot in the wedge. This feature allows compression of the wedge. Thus, tight closing and easy opening are assured despite body expansion or contraction due to temperature changes.

Secondly, wedge travel is guided for perfect alignment by *double* wedge grooves and *twin* body ribs. Canting of wedge caused by line pressure is thus eliminated, preventing damage to downstream seat.

Here's a combination that just naturally means more reliable operation . . . less trouble, less maintenance, less cost!

Outline your service requirements and get *complete* information on Darling Valves of the proper type. Or, send for the 300-page Darling Catalog No. 17M. It describes Darling Valves of all types and sizes . . . and is full of data of general value . . . yours for the asking.

DARLING VALVE & MANUFACTURING CO.
WILLIAMSPORT 8, PA.



Darling
Slotted Wedge
Cast steel gate valves

Darling Gate Valves, noted for outstanding quality, strength and precision, are made in a wide range of sizes, types and constructions for all kinds of normal and unusual service ... and for pressures up to 1500 pounds. In addition to the *Slotted* wedge types, there are solid wedge taper seat valves and the famous Darling Fully Revolving Double Disc Parallel Seat Gate Valves for virtually any service.

DARLING
TRADE DARLING MARK
VALVES

THE VALVE MARK OF QUALITY... WATCH FOR IT

Now . . . buell SF ELECTRIC PRECIPITATOR

This announcement of the availability of a made-in-America "SF" Precipitator is NEWS of broad significance. With a Precipitator, also, Buell is in a position to provide any efficiency desired in the collection and recovery of fine and ultra-fine dusts.

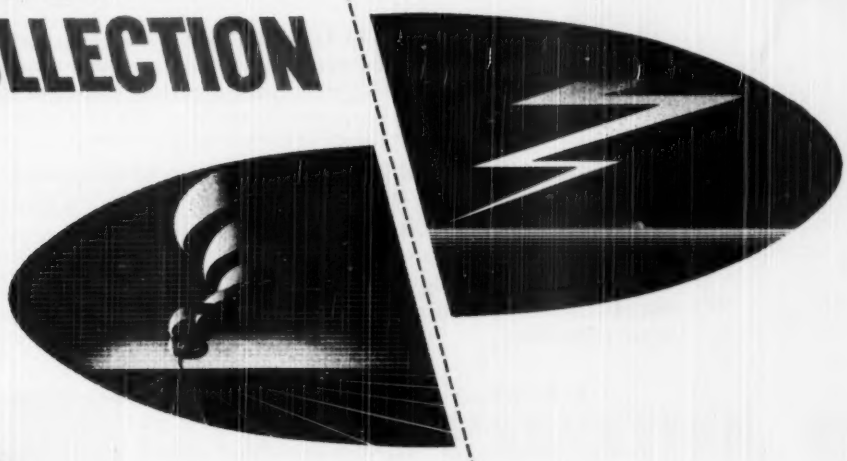
The Buell "SF" Electric Precipitator is made under license from Svenska Fläktfabriken, subsidiary of ASEA (Swedish General Electric Company). Through 18 years of engineering experience and more than 150 installations in 11 countries, the broadest range of operating conditions have been met. The "SF" Precipitator now takes up equivalent first line service in the Americas:

- in separating and collecting dusts of value suspended in process air or gases.
- in fly ash and nuisance dusts collection for general air pollution abatement.

Sizes and types of equipment are standardized to meet all needs.

The Buell Sales Engineering Staff invites opportunity to discuss specific problems. Write, wire or telephone.

World experience in both techniques of DUST COLLECTION



buell van Tongeren CYCLONE

Scientific dust collection and the doing away with air pollution was just coming into its own in 1935, when Buell introduced to America the high-efficiency van Tongeren designs of AERODYNE.

The Buell van Tongeren Cyclone pioneered in lifting centrifugal dust separation onto a new high plane. How solidly its patented van Tongeren Shave-off contributed to reaching otherwise unobtainable efficiencies is evidenced in the multi-industry use of this Buell System—and 15 year records of multiple re-orders.

For many, many conditions the Buell van Tongeren Cyclone is bound to be first preference, with fractional efficiencies, costs, operating simplicity and long-term reliability all taken into account. Catalog on request.

buell
ENGINEERING COMPANY
70 Pine Street, Suite 5045, New York 5, N. Y.

are businessmen

COLD-BLOODED?

OF COURSE NOT! Literally, their normal body temperature is 98.6—same as laborers, engineers or any other group of people. And, figuratively, they're no more, or no less, cold-blooded—as a group.

We all know unreasonable generalizations can be dangerously false. Common sense and on-the-job experience show us the value of dealing specifically with ideas, problems—and *people.*

Let's not make the big—and costly—mistake, then, of generalizing on religious or racial groups. Adopt and *carry out* these common sense principles:

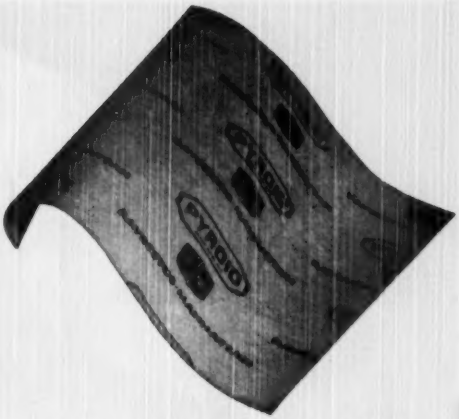
1. Accept—or reject—people on *their individual worth.*
2. Don't listen to or spread rumors against a race or a religion.
3. Speak up, wherever we are, *against* prejudice. Work for understanding.

A PUBLIC SERVICE PROJECT
THE ADVERTISING COUNCIL

Published in the public interest by:

McGraw-Hill Publications

two outstanding sheet packings for long-lasting gaskets



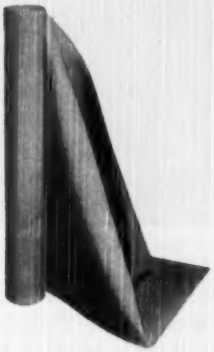
R/M NO. 650, "PYROID"

For public utilities, for power plants of all varieties, Raybestos-Manhattan manufactures a diversified line of gasket sheets that can be relied on for long, trouble-free service.

R/M "Pyroid" Compressed Asbestos Sheet Packing, No. 650, is the standard in thousands of power plants and refineries where it is called upon to resist high pressures and temperatures, and the solvent action of petroleum derivatives. A dense pliable sheet of exceptional tensile strength, "Pyroid" is made by one of America's largest manufacturers of sheet packing.

R/M No. 625 Red Rubber Sheet Packing is another widely used product. It is a tough, long-lasting resilient sheet, recommended for use against air, water, or steam at low pressures.

Other R/M sheets that have demonstrated their quality in service include R/M No. 670, a low-cost compressed asbestos sheet approved by the National Board of Fire Underwriters for use with gasoline, benzol, etc.; R/M No. 635, a Flexlastic C.I. sheet for cold water, low pressures, and general service; R/M No. 645, a diaphragm sheet of high-tensile square woven duck, covered with best grade Flexlastic and widely used in water, oil, air, and gas damper regulators. These and many others are manufactured by R/M to solve your gasket problems.



R/M NO. 625

RAYBESTOS-MANHATTAN, INC.

PACKING DIVISION, MANHEIM, PA.

FACTORIES: Bridgeport, Conn. • Manheim, Pa. • No. Charleston, S.C. • Passaic, N.J.

RAYBESTOS-MANHATTAN, INC., Manufacturers of Packings • Asbestos Textiles • Mechanical Rubber Products • Abrasive and Diamond Wheels Rubber Covered Equipment • Brake Linings • Brake Blocks • Clutch Facings • Fan Belts • Radiator Hose • Powdered Metal Products • Bowling Balls

Raybestos-Manhattan, Inc. P-50
Packing Division, Manheim, Pa.

Gentlemen: Please send me data on "Pyroid" and other R/M sheet packings.

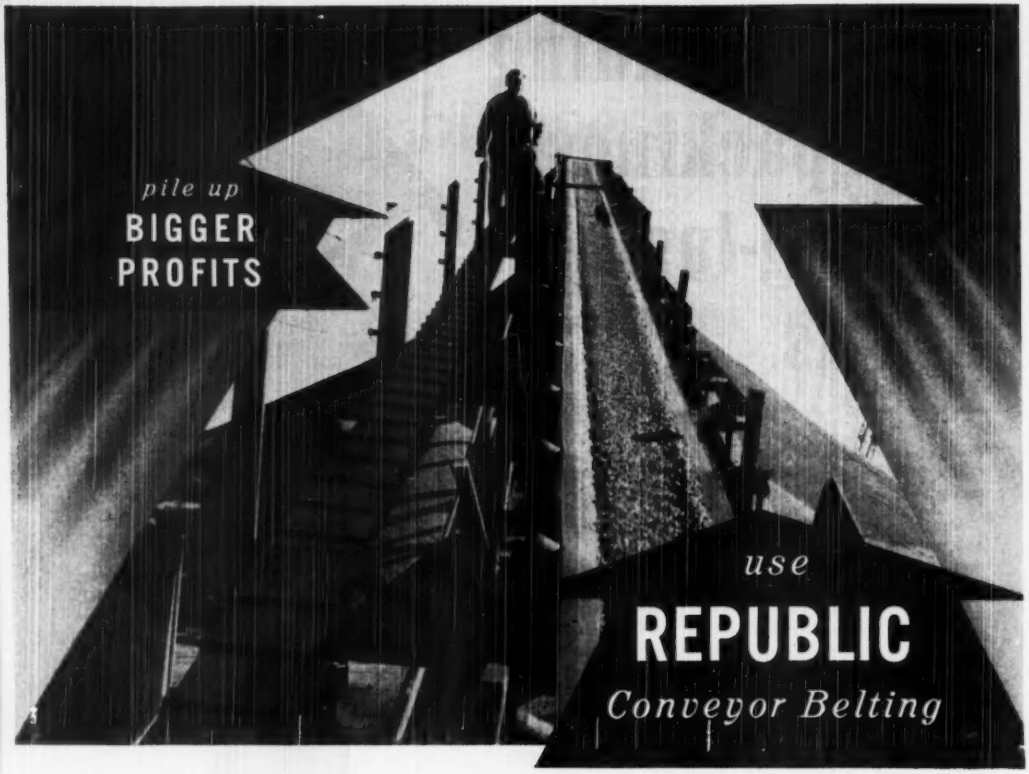
Name _____

Position _____

Company _____

Address _____

City _____ Zone _____ State _____



● One of many Republic Conveyor Belts now helping users pile up bigger profits is the 24-inch Record Maker pictured above.

For nearly three years, this Republic Belt has been in constant use at the Coon Valley Sand & Gravel Company in Des Moines, Iowa.

It's a standard type belt fitted to the job by an experienced Republic Distributor, the Globe Machinery & Supply Company, and, although continually exposed to extreme and varying weather conditions, it has handled hundreds of tons of abrasive aggregates. Today, the same belt is hard at work . . . still going strong.

If, like thousands of conveyor belt users, you want custom-built features which give you results like this, without incurring special fabricating charges, check with Republic. Your local Republic Distributor carries in stock hundreds of job-designed industrial rubber goods items, like Record Maker Belting. He can give you immediate and expert service in every field of application.

Remember, Republic has been *the* specialist in development and manufacture of industrial rubber goods for more than 48 years!

Mr. C. W. Helstrom, Vice-President, Manager
Globe Machinery & Supply Company
Des Moines, Iowa

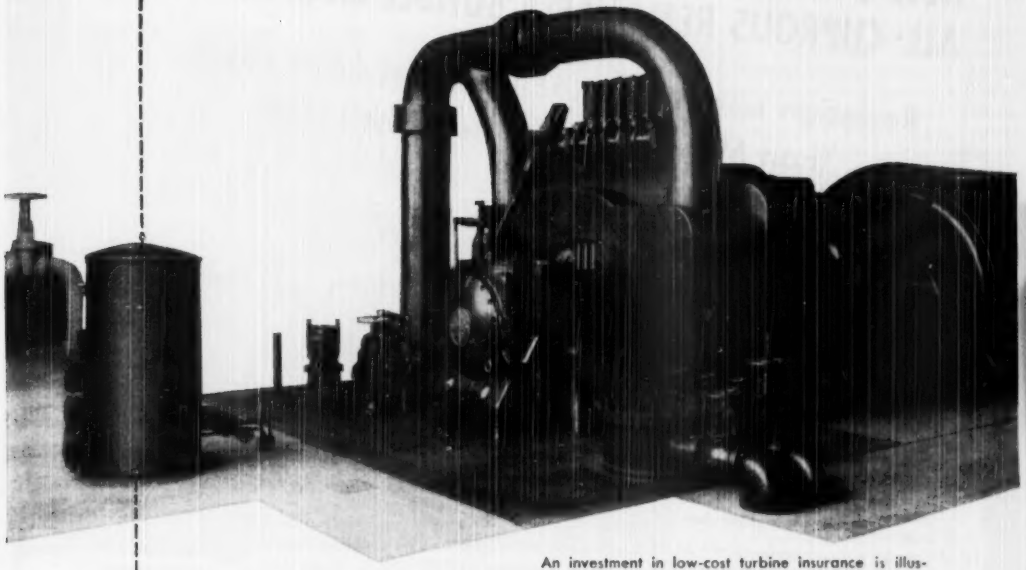
Pioneers in the use of COLD RUBBER

REPUBLIC RUBBER DIVISION
LEE RUBBER & TIRE CORPORATION, YOUNGSTOWN, OHIO
Lee Deluxe Tires & Tubes - - - Conshohocken, Pa.

MECHANICAL RUBBER GOODS BY
REPUBLIC RUBBER DIVISION

for trouble-free operation...at lower cost

keep TURBINE OILS free from sludge and abrasives



An investment in low-cost turbine insurance is illustrated above. Here, a Honan-Crane Lube Oil Purifier is direct-connected to a 25,000 KW General Electric Steam Turbine that furnishes power for the Lake Charles plant of the Cities Service Refining Corp.

HONAN-CRANE OIL PURIFICATION

protects Vital Mechanism . . . keeps Neut. Number LOW

Honan-Crane Turbine Oil Purification is dependable insurance against abrasive contamination and products of oxidation which interfere with safe, efficient turbine operation.

Honan-Crane Purifiers remove damaging abrasives . . . prevent dirty oil from reaching vital turbine mechanism. Efficient Honan-Crane purification removes all products of oxidation . . . restores and maintains lubricating properties of the oil . . . keeps neut number and steam emulsion number within desired limits.

Many large utilities throughout the country depend on Honan-Crane Oil Purification to eliminate costly shut-downs and repairs due to contaminated oil. List available on request.

Write for complete information.

Honan-Crane Oil Purification Provides Maximum Protection for DIESELS

Time-tested engineering features have made Honan-Crane first choice for Diesel oil purification because Honan-Crane Purifiers not only remove all solid contamination, sludge and abrasive particles which endanger engine bearing surfaces . . . but also remove all products of oxidation . . . acids, asphaltenes, resins, etc., which may destroy bearing clearances by corrosive action on the metal.

HONAN-CRANE CORPORATION
1200 Sixth Street • Lebanon, Indiana
A Subsidiary of
HOUDAILLE-HERSHEY CORP.

This is News!

NEW LOW PRICES OPEN WAY FOR WIDE USE OF ALL-CUPROUS REMOVABLE BUNDLE EXCHANGERS

Redesign and Mass Production Set Costs Lower Than Many Iron and Steel Shell Units

BUFFALO, N. Y.—Extensive redesign of the Ross Type BCP Exchanger, famed for its service on U. S. Navy combat vessels, opens the way for industry-wide use, announces Ross Heater & Mfg. Co.

New, low prices now make an all-copper and copper alloy, removable tube bundle unit available at a considerable saving over cast iron and steel shell units, especially in the smaller sizes, and at competitive costs in many of the larger sizes.

These developments are predicted to have an extremely favorable effect, of far reaching proportions, on both original equipment manufacturers furnishing exchangers as accessories, and industries utilizing exchangers in their own plants.

Boasts larger transfer surface in same size unit

Full standardization and quantity production, bringing about the new, low prices, were not the sole objectives and results of the redesign, Ross points out. Sharing the limelight is the substantial increase in heat transfer surface.

In many instances, a smaller, less expensive Ross Type BCP now serves the same conditions that formerly required a larger, costlier exchanger of conventional design. Passages between tube bundle and shell, that normally remain unused, are filled with an extra ring of tubes in the new Type BCP. By thus eliminating a short circuit of fluid around effective tube surface, and by introducing an improved close tolerance baffle system, Ross has achieved better fluid distribution, hence increased transfer surface. Tubes, even though there are now more of them, have not decreased in size.

Production system speeds shipments

Typically Ross-standardized and Ross-quantity-produced, components and sub-assemblies of Type BCP Exchangers are being carried in stock. Quick assembly to standard or individualized specifications, therefore enables quick shipments.

Offers informative, new literature

Now ready for distribution is a colorful new bulletin (No. 2.2K1) describing and illustrating in detail the design features of the new Ross Type BCP. Copies will be forwarded without charge to anyone requesting on company letterhead.

ROSS

ROSS HEATER & MFG. COMPANY, INC.

Division of AMERICAN RADIATOR & Standard Sanitary CORPORATION

1415 West Ave. Buffalo 13, N. Y.

In Canada, Horton Steel Works, Limited, Fort Erie, Ont.

Serving home and industry

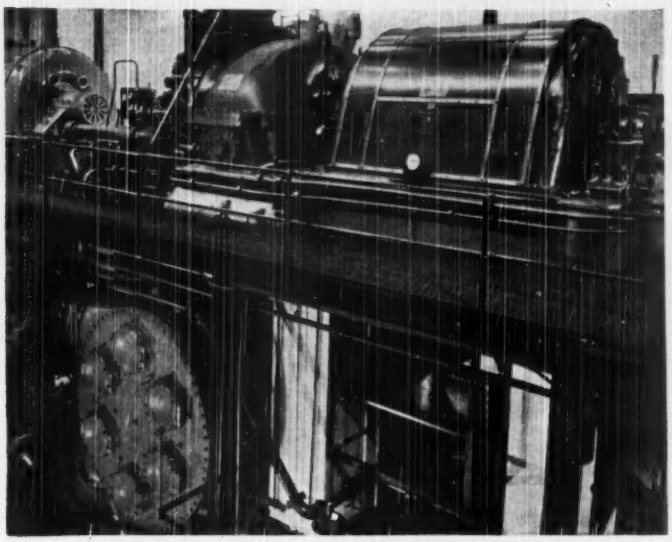
AMERICAN-STANDARD • AMERICAN BLOWER • THRIFT SEATS • DETROIT LUBRICATOR • KEWANEE BOILERS • ROSS HEATERS • TONAWANDA IRON

COPPER ALLOY BULLETIN

MARINE AND POWER EDITION

REPORTING NEWS AND TECHNICAL DEVELOPMENTS OF COPPER AND COPPER-BASE ALLOYS

Prepared by Bridgeport Brass Company "Bridgeport" *Headquarters for BRASS, BRONZE, and COPPER*



10,000 K.W. turbine and condenser installed in 1924. The Worthington condenser is a 16,000 sq. ft. 2-pass unit. Courtesy United Illuminating Company, Bridgeport, Conn.

Planned Program of Maintenance

Raises Condenser Tube Efficiency

An organized maintenance program and a wary eye for changes in operating conditions can help to extend the efficiency and life of condenser tubes in power plants.

Up until six years ago, condenser tubes in the Steel Point powerhouse of the United Illuminating Company, Bridgeport, Conn., gave little trouble. The plant, containing eight condensers with a total tube area of 155,000 sq. ft., is situated on the Bridgeport harbor.

Three condensers, installed with Admiralty tubing in 1923 and retubed with the same alloy in 1933, are still in service. Water velocity is approximately 4.8 ft. per second. These units are only utilized 50% of the time.

Two of four condensers set up from 1926-1929 with Admiralty have not been retubed. The other two were retubed in 1947 and 1948 respectively. Water velocity is about 5.6 ft. per second. The units are utilized about 75% of the time.

Failures Heavy in 1944

However, a 2-pass condenser installed in 1941 with Admiralty tubing of 26,000 sq. ft. of area started to give much trouble in 1944. This unit is operated full time.

Failures from air impingement corrosion occurred six to eight inches from the inlet end of the second-pass section. Water velocity at this section was found to be approximately 7.7 ft. per second, as compared to about 5.4 ft. per second in the first-pass. Entrained air was found to be exceptionally high.

Venting and other steps were taken to reduce the amount of entrained air and a protective coating was applied six to eight inches from the mouth of the inlet ends of the tubing. Rapid failure was checked but tubes continued to fail.

In 1947, one-half of the second-pass section was retubed with Admiralty and aluminum brass tubes. The latter contains about 77% copper, 2% aluminum, 0.03% arsenic and balance zinc. Aluminum brass has good resistance to air impingement corrosion. Aluminum brass was used for the second half of the section in 1948. No failures have occurred since then.

Maintenance Program

The company believes in carrying out a planned program of maintenance for better operating efficiency. The main points of U. I. C.'s program at Bridgeport include:

1. Cleaning tubes three times a year using rubber plugs.
2. Daily chlorination for half-hour period with special equipment.
3. Weekly inspection and washing out of waterboxes.
4. Coating tubes with a protective material for six to eight inches from inlet end.
5. Close recording of tube failures.
6. Use of sawdust to stop leaks until plugging of tubes is possible.

Three Cleaning Periods

First, in April. Due to spring thaw which occurs in March, the rivers are heavy with mud and debris and this is eventually carried into the condensers.

Second, in July. Increased temperature tends to promote growth of algae and slime. In addition spawning occurs during June.

Third, in November. River waters during this month start to get colder and cleaner.

To prevent debris from entering the condensers, trash racks with bar spacings of 2½ inches are used in conjunction with rotating screens of ⅜-inch mesh.

Experimentation includes several sample tubes of other alloys in one condenser. This is part of a program to select the best alloy to meet demands under actual operating conditions.

For experimental work of this nature, Bridgeport's Corrosion Laboratory will be glad to supply operators with technical information on available condenser tube alloys. Write for Condenser Tube Manual.

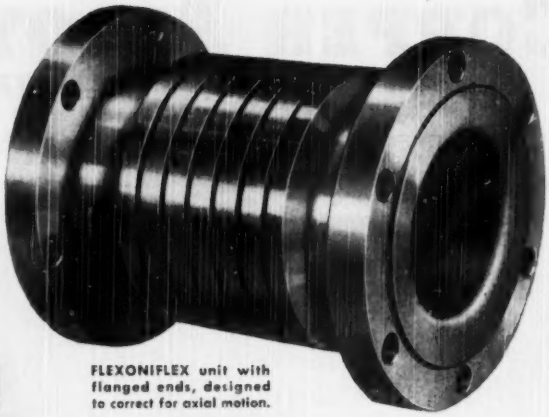
BRIDGEPORT BRASS

BRIDGEPORT BRASS COMPANY, BRIDGEPORT 2, CONN. • ESTABLISHED 1865

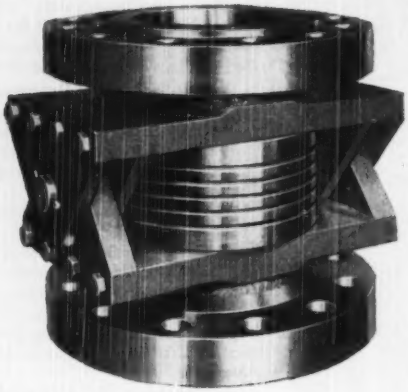
Mills at Bridgeport, Connecticut, and Indianapolis, Indiana • In Canada: Noranda Copper and Brass Limited, Montreal

(Advertisement)

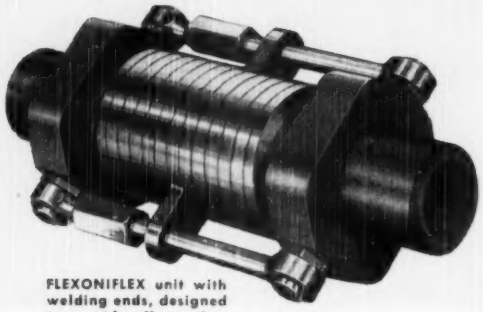
CMH Flexoniflex EXPANSION JOINTS



FLEXONIFLEX unit with flanged ends, designed to correct for axial motion.



FLEXONIFLEX unit with flanged ends, designed to correct for radial motion.



FLEXONIFLEX unit with welding ends, designed to correct for offset motion.

Proved-in-service Motion Control for the 1500 psi Pressure Range

Axial, offset and radial motion in high pressure piping systems is effectively absorbed by CMH FLEXONIFLEX Expansion Joints. 1500 psi is a nominal pressure. FLEXONIFLEX units have been and will be designed and manufactured for much greater pressures. The revolutionary design of these units—bellows-type pressure carriers formed within integral control rings and end sections—now makes it possible to utilize the expansion joint's advantages of compactness and simplicity of installation at pressures far beyond those which had previously been considered safe.

Standard FLEXONIFLEX units have stainless steel pressure carriers, single or multiple ply, lined or unlined. Sizes range from 5/8" through 6" I.D. although larger sizes can be furnished. Suitable for temperatures from sub-zero to 1400°F. (higher with special materials).

For specific recommendations send complete details of your application.

Flexon identifies CMH products that have served industry for over 48 years.

CHICAGO METAL HOSE Corporation

1301 S. Third Avenue • Maywood, Illinois • Plants at Maywood, Elgin and Rock Falls, Ill.
In Canada: Canadian Metal Hose Co., Ltd., Brampton, Ont.

CMH

ONE DEPENDABLE SOURCE

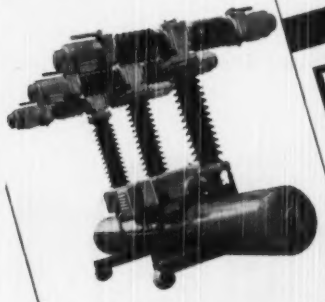
for every flexible metal hose requirement

Convoluted and Corrugated Flexible Metal Hose in a Variety of Metals • Expansion Joints for Piping Systems
Stainless Steel and Brass Bellows • Flexible Metal Conduit and Armor • Assemblies of These Components

ADVANCED OR CONVENTIONAL?

Advanced, Of Course—and in Breakers, It's the Air Blast Breaker!

BROWN BOVERI AIR BLAST BREAKERS REQUIRE MINIMUM MAINTENANCE



BROWN BOVERI OUTDOOR AIR BLAST BREAKER
TYPE DCF 80 k 1200

Rated kV — 69
Minimum kV for rated Int. Mva — 60
Insulation Level
Low Frequency 196 kV
Impulse Crest 350 kV
Current Rating
Continuous 800 Amps.
4 Second 20,000 Amps.
Interrupting Rating
1200 Mva 60 to 92 kV
Max. Interrupting Amps: 11,000
Speed: 3 cycles

THE contacts of a Brown Boveri Air Blast Breaker are not damaged even after a heavy short circuit. And, the cooling section of the air blast is so strong that these breakers are guaranteed for 50 full capacity interruptions (many times that number in normal operation) without any parts replacement. Therefore, *maintenance is at a minimum.*

If a check on breaker conditions is desired, (especially on initial operation) inspection is simple and easy. No oil to contend with — no heavy moving parts. All parts to be inspected or maintained can be lifted by one man — one of the many reasons why more and more utilities and industries specify BROWN BOVERI AIR BLAST BREAKERS.

ALL THESE ADVANTAGES . . . *and At No Extra Cost!*

1—HIGH INTERRUPTING CAPACITY—10,000,000 kVA at 230 kV
2—HIGH CURRENT CARRYING CAPACITY—4,000 Amps. at 7.5 kV
3—HIGH SPEED—3 cycles or less
4—NO OIL — NO MESS — NO FIRE
5—QUICK & EASY TO INSPECT
6—MINIMUM MAINTENANCE
7—RAPID RECLOSING—Both 3-phase or single phase.
8—POSITIVE INTERRUPTION UNDER ALL CONDITIONS including short circuits—normal load—magnetizing or charging currents.
9—SAFETY—No secondary damage even if highly overstressed.
10—DEPENDABILITY—15 years of satisfactory performance throughout the world.
11—LOW INITIAL COST & MAINTENANCE—Costs no more than other types of breakers.

WORLD ENGINEERING & MANUFACTURING LEADERSHIP IN MECHANICAL & ELECTRICAL POWER EQUIPMENT—FOR OVER 50 YEARS.

SWITCHGEAR • REGULATORS • RELAYS
MOTORS & TRANSFORMERS • TURBINES

WRITE FOR SPECIFICATIONS AND DATA!

BROWN BOVERI CORP., 19 Rector Street, N. Y. 6
Please send me specifications and details on your ☐ indoor ☐ outdoor air blast breakers for ____ kV ____ Amps. ____ kVA.
Name _____ Title _____
Company _____
Address _____

BROWN BOVERI

BROWN BOVERI CORP., 19 Rector St. • New York 6, N. Y.

Who's worth more ...and why?

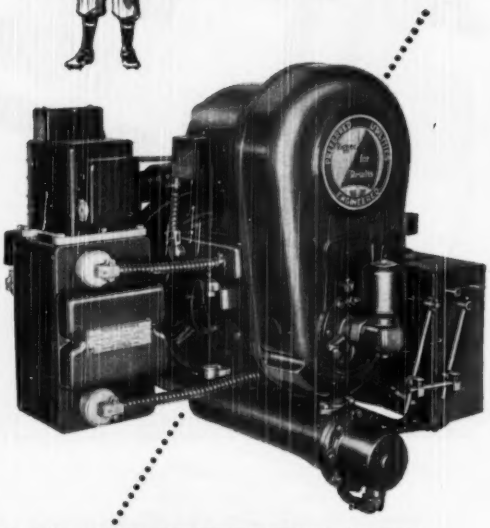
Batting Average .350

Batting Average .241

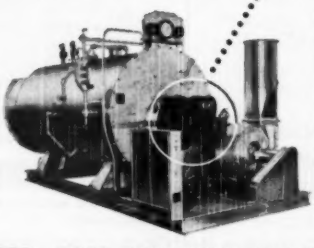
The .350 hitter, of course. He's the "money-player" because of a lot of important *plus* factors . . . a keener eye, better timing, a perfect stance, big-league experience. The same is true in package boilers, too. The Preferred Unit Steam Generator has an important edge because it offers a host of *cost-saving design extras.*

Take the belt-driven 4700 rpm. Horizontal Rotary Oil Burner, for example. It was specially designed by Preferred for firing into the elongated furnace of the Preferred Unit . . . assures *fully automatic operation* even with No. 6 oil and the new catalytic residuals. Its patented Voluvalve exactly meters a predetermined quantity of oil to the burner regardless of changes in temperature, pressure or viscosity.

Want to know more about what makes the Preferred Unit a star performer? Send for Bulletin 1000 giving all the facts.



7 "WORTH-MORE" FEATURES OF THE PREFERRED UNIT



- 4-pass, high velocity, gas travel — minimizes tube cleaning maintenance by self-cleaning action.
- Staggered tube construction — minimizes the possibility of tube pitting, even at *low* firing rates.
- Anti-stress deck for tube sheet protection.
- Self-cleaning *induced draft* fan with air cooled shaft and bearings — built to last 30 years.
- Down-draft gas travel for 80% thermal efficiency — proved and guaranteed.
- Special *precipitator* developed by Preferred as aid to safe and clean operation.
- Dual purging cycles for positive elimination of gas stratification.

PREFERRED UTILITIES MFG. CORP., 1860 BROADWAY, NEW YORK 23, N. Y.

PR 184

PREFERRED UTILITIES MFG. CORP.

WeldELLS®

Whatever you seek on that next welded piping job...*speed*...*economy*...piping for *extreme conditions*...piping to withstand *corrosion*...you will find the answer to it in piping welded the WeldELL way.

You will find the answer because the WeldELL line incorporates job-speeding, cost-cutting features that are combined in no other welding fitting.

You will find the answer because the WeldELL line expresses the best of all we have learned in fifty years of intensive specialization in forged fittings for designed piping and pressure vessels.

The WeldELL line also goes beyond all others in range of sizes, types, thicknesses and scope of materials. Form a good habit—the WeldELL habit. Your reward will be the deep-down satisfaction of using the best there is! Coupon brings catalog.

Taylor Spiral Pipe is again promptly available in a broad range of sizes and thicknesses. Coupon brings new Spiral Pipe Bulletin 493.

TF

TAYLOR FORGE

TAYLOR FORGE & PIPE WORKS, P.O. Box 485, Chicago 90, Ill.

Offices in all principal cities.

Eastern Plant: Carnegie, Pa. • *Western Plant:* Fontana, Calif.

☐ Please send new Catalog 484 covering welding fittings and forged steel flanges.

☐ Send new Bulletin 493 covering Taylor Spiral Pipe and related fittings.

NAME_____

POSITION_____

COMPANY_____

STREET ADDRESS_____

CITY_____ ZONE____ STATE_____

501-0550 Mail to Taylor Forge & Pipe Works, P. O. Box 485, Chicago 90, Ill.

No job is too unusual for NAVCO

Whether you require a simple pipe bend or a complicated prefabricated assembly, Navco can help you. As shown above, Navco Shops are equipped to handle Chrome Moly, Stainless, Carbon Steel and Copper, in addition to any of the many other Ferrous and Non-Ferrous materials.

NAVCO PIPING

NATIONAL VALVE & MANUFACTURING COMPANY • PITTSBURGH, PA.

NEW YORK • CHICAGO • CLEVELAND • BOSTON • ATLANTA • TULSA • BUFFALO • CINCINNATI

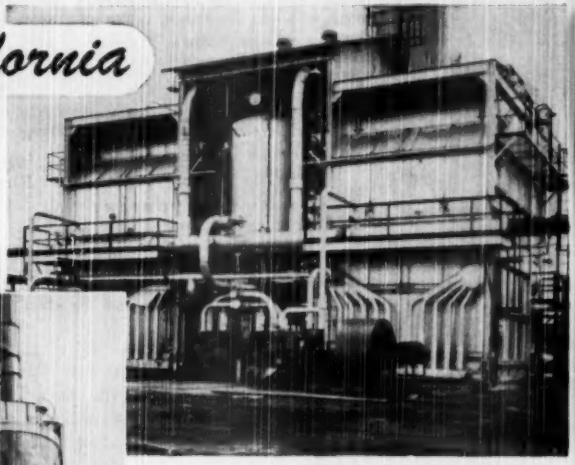
BOILERS BUILT THIS WAY REQUIRE NO COSTLY HOUSING

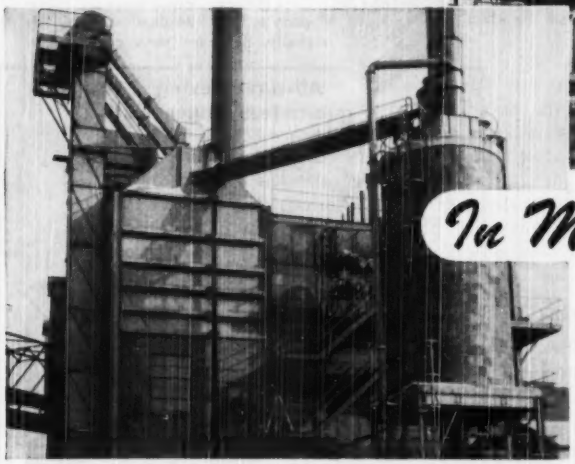
ERIE CITY has developed, manufactured and erected many **outdoor** boilers that require no costly housing structures. Our long experience with heavily insulated, completely steel cased industrial boilers is being applied to outdoor installations. Representative units in California and Michigan are shown here.

Have you investigated the interesting savings possible with Erie City Outdoor Steam Generators? Write for recommendations.

In California

2 Erie City 3-Drum 1050 h.p. 300 W.S.P. **Outdoor** Boilers, Oil or Gas fired, serving a large refinery.





In Michigan

An Erie City 3-Drum 890 h.p. 675 W.S.P. **Outdoor** Boiler, chain grate stoker fired, serving large brass goods manufacturer.

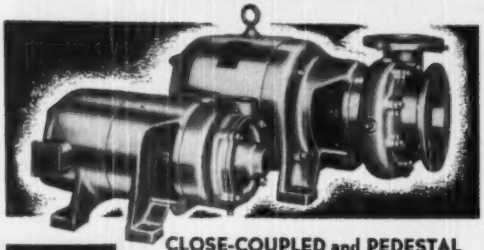
ERIE CITY

COMPLETE STEAM POWER PLANT EQUIPMENT

Complete Steam Generators • Type C 3-Drum Boilers • Type VL 2-Drum Boilers • The "Economic" Boiler with or without Water Walls • Welded H. R. T. Boilers • Welded Steel Heating Boilers • Coal Pulverizers • Underfeed and Spreader Stokers • Welded Pressure Vessels for the Process Industries.

ERIE CITY IRON WORKS • ERIE, PA. • *Since 1840*

New... Different
THE "ALTA" LINE
FOR INDUSTRIAL USE



CLOSE-COUPLED and PEDESTAL GORMAN-RUPP PUMPS

This new line of centrifugal pumps combines all the advantages of exact hydraulic engineering with best mechanical design.

Alta Pumps are outstanding in efficiency serving a capacity-head range up to 1000 G.P.M. and 200 feet head with 14 sizes, 1 to 4 inches.

Open as well as enclosed type impeller for slurry and other services.

For detailed information ask for Bulletin 9-IP-11.

THE GORMAN-RUPP COMPANY
MANSFIELD, OHIO

New Printings Available

STEAM TURBINES
•
STEAM GENERATION

Because of continuing demand for these comprehensive and authoritative special sections, we have just made an additional printing and can now supply new orders. Price remains the same: 60¢ for single copies, 51¢ for 100 or more, 46¢ for 500 or more, 41¢ for 1000 or more, and 37¢ for 2000 or more.

Address your orders to:
Editorial Dept.

POWER
330 W. 42nd Street, New York 18, N. Y.

When the fit's tight you're glad it's a **Badger** Joint

Large unwieldy fittings have no place in the complicated pipe line layouts used today. Badger Directed Flexing Packless Corrugated Expansion Joints, thoughtfully designed to give the utmost in performance yet use a minimum of space, cause no installation problems. Outside diameter of the expansion joint is little more than outside diameter of a flanged pipe fitting.

Take a tip from the leaders in every field where piping is a problem — save space and get top performance by specifying Badger Directed Flexing Packless Corrugated Expansion Joints.

Fresh from the press!

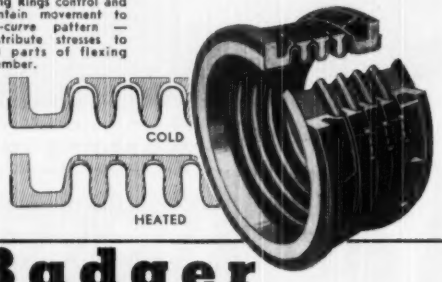
. . . Badger Manufacturing Company's new 24-page catalog is ready. Send for your copy today.

All-curve flexing guarantees longer life

Badger Joints flex like this . . .

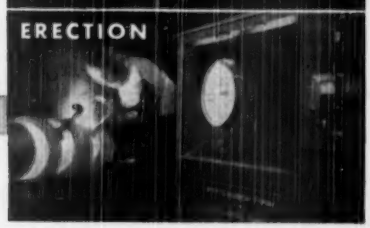
not like this . . .

EXCLUSIVE construction of Badger Joints eliminates localized flexing stresses that cause breakdowns. Directed Flexing Equalizing Rings control and contain movement to *all-curve* pattern — distribute stresses to all parts of flexing member.



Badger
MANUFACTURING COMPANY
230-260 BENT STREET CAMBRIDGE 41, MASS.

THE FIRST STEP
is
All You Need Take



WHEN YOU TURN THE COMPLETE POWER PIPING JOB OVER TO P. P. & E.

Just take one step when you need new power piping. Turn the complete job over to P.P.&E. By placing this responsibility in our hands you obtain the advantages of a distinctive engineering technique, complete shop fabrication facilities, specialized metallurgical control methods complete with model testing, and skill in meeting and solving present-day field erection problems. Furthermore, you are relieved of detail . . . and utilize to the utmost the knowledge we have accumulated through almost a half century of practical experience in this field. Ask our nearest representative for further information.

Pittsburgh Piping
AND EQUIPMENT COMPANY
10 Forty-Third Street—Pittsburgh, Penna.

Woolworth Building, New York
Whitehead Building, Atlanta
Book Tower, Detroit
525 Market Street, San Francisco
Peoples Gas Building, Chicago
Public Square Building, Cleveland
70 High Street, Boston
Heights State Bank Bldg., Houston

WHERE TO BUY

Featuring additional products specialties and services for power plants

BIRCH
Pump
Valves
•
Standard In
RAILROADS, MINES, WATER WORKS
INDUSTRIALS

● They increase efficiency, capacity, economy—decrease slippage, leakage, fuel consumption—will not stick in seat ports, warp, break, curl, or ride seat bridges. For hot or cold water service thoroughly dependable.

BIRCH MANUFACTURING CO.
1521 Sedgwick St. Chicago, Ill.

HILL PUMP VALVES
SINCE 1909

● The valve with the renewable feature restores old pumps to original efficiency. Constant contact is maintained over the full bearing surface no matter in what position the valve rotates because of the exclusive HILL design. Efficient, durable, economical, accurate.

Write for Bulletin
HILL PUMP VALVE CO.
2728 Elston Ave., Chicago 47, Ill.

ASSEMBLY LINE
FOLLOW THROUGH
Aircraft plants - Metal workers - Telephone, Radio, Vacuum cleaner, Washing machine manufacturers use Topflight's Pressure Sensitive, Self - Adhesive Tape. Easy to Apply.
TOPFLIGHT TAPE CO. YORK PA.

ERNST Liquid Level Gages

High and Low Alarm Columns
Split-Gland Water Gages
Sight Flow Indicators
Flat Glass Inserts
Etc.
ERNST WATER COLUMN & GAGE CO.
LIVINGSTON, N. J.

This WHERE TO BUY *Section*

supplements other advertising in this issue with these additional announcements of products and services essential to modern power plant operation. Make a habit of checking this page, each issue.

CLASSIFIED ADVERTISING DIVISION POWER

PROFESSIONAL SERVICES

BURNS & McDONNELL
Consulting and Designing Engineers
Kansas City, Mo. P. O. Box 7088
Cleveland, Ohio 1404 E. 9th St.

T. MASENG & ASSOCIATES, INC.
Engineers
Electrical, Design | Structural, Reports | Mechanical Rates
7 So. Dearborn Chicago 3, Ill.

STANLEY ENGINEERING COMPANY
Consulting Engineers
Power Plants
Steam - Diesel - Hydro
Design - Construction - Test - Valuation
Hershey Building Muscatine, Ia.

THE H. K. FERGUSON CO.
Industrial Engineers and Builders
POWER PLANT DEVELOPMENT, ENGINEERING AND CONSTRUCTION
The Ferguson Building, Cleveland, Ohio
Chicago • Houston • Los Angeles • New York City

PIONEER SERVICE & ENGINEERING CO.
Consulting and Design Engineers . . Purchasing . . Specialists in Financing, Accounting and Other Operations
231 So. La Salle St. Chicago 4

JOHN A STEVENS, INC.
Established 1909
Consulting Engineers
Power Plants | Paper Mills
Dye Houses | Surveys
Lowell, Massachusetts

GILBERT ASSOCIATES, INC.
Engineers and Consultants
Industrials and Utilities, Power Plant Design and Construction. Rehabilitation and Maintenance.
Steam — Diesel — Hydro — Sewage
Reports — Examinations — Laboratory
New York | Reading, Pa. | Philadelphia
Houston | Washington

SANDERSON & PORTER
Engineers and Constructors
New York Chicago
San Francisco Los Angeles

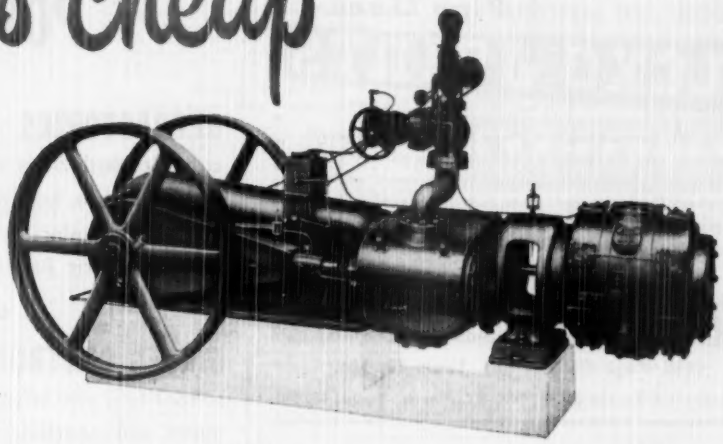
SYSKA & HENNESSY, INC.
Engineers
Consultation | Plans | Reports
Power Plants | Disposal Plants
Water Systems
144 East 39th Street
New York, New York

THE KULJIAN CORPORATION
Engineers - Constructors
Power Plants and Industrial Projects
1200 N. Broad St., Philadelphia 21, Pa.
Washington, D. C. — St. Petersburg, Fla.
Calcutta—Rome—Caracas

SARGENT & LUNDY
Engineers
140 South Dearborn St. Chicago, Illinois

THE J. G. WHITE ENGINEERING CORPORATION
Design-Construction-Reports-Appraisals
80 Broad Street, New York 4

where steam is cheap



class T-S is the ideal compressor *for small capacities*

Where steam is available at low cost, or where exhaust steam can be utilized, Chicago Pneumatic Class T-S steam-driven compressors are most satisfactory. The governor automatically varies operating speed to suit air demands, reducing wear, lengthening machine life, and minimizing operating and maintenance costs.

Of horizontal, straight-line, double-acting construction, Class T-S Compressors are furnished in a variety of steam cylinder sizes for a wide range of boiler or exhaust pressures. Outstanding features include Simplate valves . . . large, smooth air passages . . . liberally water-jacketed cylinder and heads . . . completely enclosed frame . . . one-piece crosshead . . . double-counterweighted crankshaft.

Capacities range from 89 to 1990 c.f.m., with pressures from 10 to 5,000 pounds. Other types are available for larger capacities. Write for descriptive literature.

CHICAGO PNEUMATIC TOOL COMPANY

General Offices: 8 East 44th Street, New York 17, N. Y.

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES
ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES

SIMPLICITY of DESIGN...

For Moving Pipe Lines

FLEXO JOINTS

For safe, unrestricted flow, Flexo Joints offer the strength of pipe *plus* the flexibility of hose — to convey fluids through movable pipe lines or to equipment while in motion. Just four simple parts, completely enclosed—no springs—no small or loose parts . . . long wear—low maintenance. Four styles—standard pipe sizes ¼" to 3".

Write for complete information.

FLEXO SUPPLY CO., Inc.

4655 Page Blvd. St. Louis 13, Mo.

In Canada: S. A. Armstrong, Ltd., 1400 O'Connor Dr., Toronto 13, Ont.

CHELSEA FANS

FOR INDUSTRIAL AND COMMERCIAL NEEDS

— step up production and plant efficiency, prevent HOT WEATHER SHUT-DOWNS!

The efficient, economical way to banish employee fatigue due to smoke, fumes, steam and heat. CHELSEA fans provide adequate circulation of cool, clean, fresh air — with up to a complete change of air per minute! Remember—a CHELSEA installation can save you time and money.

Heavy Duty, Belt-Driven TYPE IND

This powerful Industrial fan is scientifically designed to move huge volumes of air in factories, foundries, mines, institutions, hotels, schools, etc. Sizes 24" to 60", with air deliveries from 5500 to 40,500 CFM.

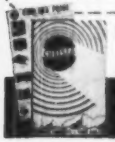
ALL TYPES • SIZES • CAPACITIES

Belt Driven Penthouse Fan TYPE PH — a completely packaged unit, all-steel housing and automatic aluminum louvers. Fits any installation — sizes from 24" to 60"; 5500 to 40,500 CFM.

Duct Booster Fan TYPE DXB — Belt driven, for paint booths, removal of fumes, and duct installations. Sizes from 16" to 42"; 2960 to 26,400 CFM.

Automatic Shutters, Horizontal TYPE LWL — Sturdy, counterbalanced, single section construction. Full 90° opening. Sizes 10" to 60".

Belt Driven, Pedestal Mancooler TYPE MC — For use where large volume, on-the-spot air circulation is required — in shops, stores, offices, etc.



WRITE FOR NEW CATALOG AND PRICE SHEET

Full information on the most complete line for '50—engineering data, installation details, etc. Address Dept. H.

CHELSEA FAN & BLOWER CO., INC.

1206 GROVE ST., IRVINGTON, N. J.

What's Ahead in

POWER

REFRACTORIES—16 pages of practical information on refractory materials: what they are, how they stand up in service, how to select and apply them. Part of the regular June issue.

•

DIESEL CONTROLS—A topnotch consultant tells you what controls and instruments are needed for fuel, lubrication, intake-air, exhaust, starting-air and cooling-water systems, and how to apply them. This exclusive series starts soon.

MODERN PLANT SURVEY—Technical highlights of new steam and hydro plants, quick summaries of new developments and trends. In the December issue.

PLUS

meaty articles on new developments, good operating and maintenance practices, and your favorite departments.

SEARCHLIGHT SECTION

EMPLOYMENT • BUSINESS • OPPORTUNITIES • EQUIPMENT—USED or RESALE

UNDISPLAYED RATE
(Not available for equipment advertising)
$1.20 a line, minimum 4 lines. To figure advance payment, count 5 average words as a line.
INDIVIDUAL EMPLOYMENT WANTED undisplayed advertising rate is one-half of rate, payable in advance.
PROPOSALS, $1.20 a line an insertion.

INFORMATION
BOX NUMBERS in care of any of our New York, Chicago or San Francisco offices count 1 line additional in undisplayed ads.

DISCOUNT of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

DISPLAYED RATE:
The advertising rate is $10.00 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns — 30 inches—to a page.

NEW ADVERTISEMENTS received by May 11th will appear in the June issue, subject to limitation of space available.

REPLIES (Box No.):
Address to office nearest you
NEW YORK: 330 W. 42 St. (18)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)

POSITIONS VACANT

WANTED CHIEF Steam Electric Engineer: Utilities Company in New Mexico. Technical graduate or equivalent with experience in operation and maintenance of modern steam-electric plant; also supervisory ability. All replies held in strict confidence. P-6013, Power.

SELLING OPPORTUNITY OFFERED

PROMINENT MANUFACTURER of centrifugal pumps desires to receive applications from manufacturer's agencies capable of giving aggressive sales representation to an extensive line, well cataloged and complete (does not include boiler feeders). Open territories are: Bangor, Charlotte, Cincinnati, Columbus, Des Moines, Harrisburg, Helena, Jacksonville, Little Rock, Memphis, Milwaukee, Norfolk, Peoria, Reno, Richmond, Scranton, Springfield, Mass., Toledo, Wichita Wilmington, Del., Youngstown. Reply RW-2453, Power.

EMPLOYMENT SERVICES

HELP WANTED Male. Openings in desirable territories for men with boiler room contacts to sell NCC sludge solvent and No-Karb soot remover. Nutmeg Chemical Co., 134 Haven St., New Haven 13, Conn.

SALARIED POSITIONS $3,500-$35,000. If you are considering a new connection communicate with the undersigned. We offer the original personal employment service (40 years recognized standing and reputation). The procedure, of highest ethical standards, is individualized to your personal requirements and develops overtures without initiative on your part. Your identity covered and present position protected. Send only name and address for details. R. W. Bixby, Inc., 270 Dun Bldg., Buffalo 2, N. Y.

When Writing Your Ad

Provide an indexing or subject word.

Write it as the first word of your ad.

If it is a Position Wanted or Position Vacant ad, make the first word the kind of position sought or offered.

This will assure proper classification in the column.

The right is reserved to reject, revise or properly classify all Want Advertisements.

Proper Classification increases the possibility of Prompt Returns

Engineers — Executives — Technical Men
Salaried Positions, $4,000 to $30,000
This Confidential service for men who desire a new connection, will develop and conduct preliminary negotiations without risk to present position. Send name and address for details.
TOMSETT ASSOCIATES
1205-2 Berger Bldg., Pittsburgh 19, Pa.

EMPLOYMENT SERVICE

SALARIED PERSONNEL $3,000-$25,000. This confidential service established 1927, is geared to needs of high grade men who seek a change of connection under conditions assuring, if employed, full protection to present position. Send name and address only for details. Personal consultation invited. Jira Thayer Jennings, Dept. G, 2451 Orange St., New Haven, Conn.

POSITIONS WANTED

POWER PLANT Supervisor, technical school graduate, 7 yrs. of power plant operation and maintenance experience. Also some refrigeration. Age 28 yrs. PW-2396, Power.

STEAM POWER Engineer, desires connection with progressive concern. Broad experience and Technical supplement in operation and maintenance of Modern Steam Plant equipment. Familiar with Water Filtration, Sewage Disposal systems. Proven Supervisory ability. Excellent references, age 30, married. PW-6305, Power.

POWER PLANT or Maintenance Supervisor, 23 years experience with one of largest Manufacturers, desires to relocate, south or south-east, utility and construction experience. A.S.M.E. and N.A.P.E. member. Excellent references. PW-6290, Power

REGISTERED ENGINEER ASME. 58, 12 years experience, automatic fired water and firetube package. Steam generators wishes responsible position development or field. Present earnings $10,000.00. PW-2464, Power.

MECHANICAL ENGINEER, B.S.M.E., age 29, recently returned from overseas service, desires affiliation with established firm, considerable experience in power generation and instrumentation. PW-6311, Power.

OPERATION-MAINTENANCE Supt. or Asst. Twenty years experience with intimate knowledge of power plant and industrial steam and elec. generation and distribution. Also maintenance in large chemical process plant. Excellent personnel training and handling record. Some design and modernization. Available at once. PW-6314, Power.

SELLING OPPORTUNITY WANTED

PITTSBURGH DISTRICT—Manufacturers Agent interested in obtaining a Water Tube Boiler Account on exclusive basis. Has aggressive, hard working engineering sales force thoroughly trained in Steam Generation. RA-6350, Power.

NEW ENGLAND

Sales Engineering Company established twenty-three years wants one more major account of Power Plant, Oil Refinery, Paper Mill or other Industrial mechanical equipment or medium and heavy steel plate fabrication. Excellent connections. Protected territory on commission basis only.

RA-6275—POWER

330 W. 42nd St., New York 18, N. Y.

INDUSTRIAL FUEL USERS
DEALERS and ENGINEERS

HERE is the REAL

PROFIT MAKER
FYR-FEEDER

REG U S PAT OFF

PAYS FOR ITSELF
BY ITS EARNINGS *QUICKLY*

Burns Wood Chips, Coal, Coke-Breeze, Sawdust and other Solid Fuels and Makes Large Savings!
★★★★Annual returns to users up to more than 100% of investment. Thousands of FYR-FEEDERS in service.

Write for Guaranteed Savings Purchase Plan
AMERICAN COAL BURNER COMPANY
Manufacturers-Engineers Since 1899
18-R East Erie St., Chicago, Ill.

WANTED
DISTRIBUTORS AND SALES AGENTS

Long established concern of operating specialty products used and endorsed by many foremost concerns. Products saleable to all kinds of factories, institutions, steamship, railroad companies and municipalities. Give full particulars. Will be treated confidentially.

RW-6249, POWER

330 W. 42nd St., New York 18, N. Y.

FOR SALE

3—1000 KVA Transformers, Penna 1/60 type OIBC 11,000 volt primary with taps, 480 volt 2000 amperes sec. Complete with explosion relief tanks, 125 v alarm contacts and thermometers. Wt. 12,800 lbs. complete with oil. Used only 90 days in excellent condition. Also insulators and bus bars.

Owner: STULTZ ELECTRIC WORKS
817-821 MAIN ST. WESTBROOK, MAINE
Tel. 1344

Generator Voltage Regulators

New — Used — Sold — Exchanged — Rebuilt

Westinghouse Silverstat General Electric GDA Allis Chalmers Rocking contact for A.C. and D.C. generators all sizes for quick delivery.

WESTERN REGULATOR EXCHANGE
1730 Wazee St. Denver 2, Colo.

One Union Iron Works Bent Water Tube Boiler 300 Horse Power, W. P. 160 Pounds With Detroit Stoker. One Economic Fire Tube Boiler 200 Horse Power, W. P. 200 Pounds. One Infilco Oil Filter. Size 48 Inch. No reasonable offer will be refused.

MEADOW GOLD PRODUCTS CO.
1337 D Street, S. E., Washington, D. C.

GLOW

SQUIRREL CAGE MOTORS

HP	RPM	Volts	Make
750	900	6600	Westgh
350	3550	2200	Westgh-CS
300	900	440	GE-I-17
300	514	440	GE-I
250	1200	440	GE-KTB
250	600	2300	Triumph
225	514	440	GE-I-14
200	440	2200	GE
200	600	440	Westgh-CS
150	600	2300	GE
125	3600	220/440	Al.Ch. AN
125	1200	440	Century
125	340	220	A-C
85	3600	2300	GE
75	1200	220/440	GE-K505Y
60	3600	2300	GE-KT
60	1800	440	Lincoln
60	1800	2300	GE-FTR
50	1800	220	Triumph
50	1200	220/440	GE-Tri-Clad
50	900	220	GE
50	720	2300	Wtg-CS
40	1200	220	GE-KT
40	900	2300	Wtg-CS
40	900	220	Lincoln
40	720	440	GE-KT
35	1800	220	GE type I
35	900	440	GE type I Form M
30	900	220	Lincoln
30	900	220	Wagner (HI-Torque)
30	720	220	GE-HJ
30	514	440	Stanley
25	3600	dual	L-A
25	1800	220	L-A, HD
25	1200	220	Weeche
25	1200	220	Century
25	1160	208/416	Wtg-CS
25	900	440	GE
25	690	220	Westgh, type CS
25	575	220	GE-type M
20	3500	440	Al.Ch.
20	1800	220/440	GE-K
20	1200	208/416	GE-KG
20	1200	440	Westgh-CS
20	900	220	Westgh-CS

ENCLOSED SQUIRREL CAGE

HP	RPM	Volts	Make
125*	1200	440	GE-TE-FC-BB
75	1200	2200	GE-TE-FC-BB
60	900	440	GE-TE-FC-BB
50	900	440	Reliance, TE-FC-BB
30	3600	dual	Delco-TE-FC-BB
30	1200	440	Wagner
30	900	440	GE-TE-FC-BB
15	1200	220/440	Delco-TE-FC-BB
15	900	440	GE-TE-FC-BB
10	3600	220/440	F-M
10	1200	440	GE-TE-FC-BB
7½*	1800	dual	Wagner-TE-FC-BB
7½*	1800	dual	Master-TE-FC-BB
7½	1200	dual	GE-HI Slip-TE-BB
7½	1200	dual	Delco
7½	1090	220/440	GE-HI-Slip
7½	900	dual	Delco-TE-FC-BB
5	3600	dual	Delco-TE-FC-BB
5*	1800	dual	Master-TEI-C-HB
5	1800	220	Wagner-TE-B-BB
5*	1200	dual	GE-TE-FC-BB
3	3600	dual	Delco-TE-FC-BB
3	1800	dual	Delco-TE-FC-BB
3	1200	440	GE-TE-FC-BB
3	900	dua.	Delco
2	1800	dual	Delco-TE-FC-BB

*New Motor

ENCLOSED SQUIRREL CAGE Cont'd.

HP	RPM	Volts	Make
2	1200	220	GE-TE-BB
2	900	220	Wagner-TE-BB
1½	1800	dual	L.Al-TE-BB
1½	1200	dual	Delco-TE-FC-BB
1½	900	dual	Delco-TE-FC-BB
1	3600	220	Haskins-TE-FC
1	1800	dual	Master-TE-FC-BB
1*	1800	dual	Delco-TE-BB
1	1200	220	GE-KT
	3600	440	Delco-TE
¾	1800	dual	Weeche-TE-BB
¾	900	dual	Delco-TE-FC-BB
½	1800	440	Delco-TE-BB
½	1800	dual	Delco-TE-BB

SLIP RING MOTORS

HP	RPM	Volts	Make
500	900	440	GE-3 Brg
400	1200	2300	Al.Ch.
375	1800	2300	Al.Ch.
350	900	2300	Westgh
300	720	2300	Al.Ch.
250	720	440	GE-MT
250	900	2300	Al.Ch.
235	1800	220	GE-I
200	1800	440	Al.Ch.
150	1750	440	GE-MT
150	900	2300	Al.Ch.
100	1200	550	Westgh-CW
75	1800	220	GE
75	900	440	Al.Ch. ANY
75	720	2300	Wagner type BR
60	1800	dual	Al.Ch.
60	900	2300	Burke
60	900	220	Weeche
50	1800	220	GE-MT
50	900	2300	Ridgeway
50	900	440	Wagner
50	720	440	Al.Ch.
40	1200	220	GE-MT-336
40	900	220	A-C
40	720	2300	Wtg-HF
40	720	220	Al.Ch.-ARY
40	600	2300	Al.Ch.-ARY
40	600	220	Al.Ch.-ARY
40	450	220	Triumph-C
35	900	2200	GE
35	900	220	Al.Ch.
35	900	2300	Ridgeway
35	720	220	GE
35	570	440	GE-I
30	1800	2300	Wtg-CW
30	1800	2300	GE
30	1200	440	Wagner
30	900	220	GE-MT
30	600	220	F-Morse-BV

VERTICAL MOTORS

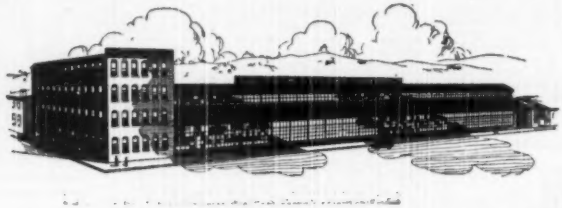
HP	RPM	Volts	Make
200	1200	440	Al.Ch.-SR
150	1200	2300	GE-I-SR
150	1200	440	GE-Cage
125	1200	2300	Al.Ch.-SR
125	1200	2300	Al.Ch.-Cage
100	1200	440	GE-Cage
75	1200	2200	GE-Cage
75	360	220	Ideal-Cage
60	1800	230 LC	GE
60*	1200	440	ALCh.-C

VERTICAL MOTORS—Cont'd.

HP	RPM	Volts	Make
50	1200	2200	Wtg-Cage
50	600	440	Al.Ch.-Cage
40	1800	220	GE-Cage
40	1700	230 DC	GE
40	1200	440	GE-SR
40	1200	2200	Westgh-BB-Cage
34	1200	2300	Al.Ch.-Cage
33	450	440	GE-Cage
30	1200	dual	Wtg-Cage
25*	1550	230 DC	GE
25	1200	2200	GE-Cage
25	850	230 DC	Wtg.
20*	1200	440	Al.Ch.-Cage
20	900	230 DC	GE-RC
15*	1800	440	Al.Ch.-Cage
15	1750	110 DC	Wtg
15	1150	230 DC	GE
15	600	440	Al.Ch.
12½	900	220	L.Al-Cage
10	3400	230 DC	Wtg.
7½	1800	500 DC	Peerless
7½	900	440	Burke
7½	700	230 DC	GE
6	850	110 DC	Rel.
5	1400	115 DC	R & M
5	600	440	GE-Cage
4	1650	110 DC	Watson
3	3600	dual	Delco
3	1700	230 DC	Watson
3	1200	dual	Wtg-Cage

SYNCHRONOUS MOTORS

HP	RPM	Volts	Make
3000	720	4800	GE-ATI
1015	500	2200	Wtg-25 cycle
710	720	13200/6600	GE
500	514	440	GE
435	720	2300	GE type ATI
320	900	2300	GE-ATI
250	1800	2300/4160	GE-ATI
250	225	2200	GE-TS
225	900	4160	GE-ATI
220	600	2300	GE-ATI
175	225	220	GE-TS (rotor & stator only)
160	600	440	GE-ATI
160	164	480	GE-TRF (rotor & stator only)
150	1800	2200	GE
150	1800	220	GE-ATI, single bearing
150	900	440	Star
150	720	440	Westgh
120	225	220	E-M (rotor & stator only)
115	164	208	GE
100	1200	220	Wstg single bearing
95	1200	220	Burke
75	1200	220	Westgh
75	900	2300	GE-ATI-7552
60	360	2200	GE (rotor & stator)
50	1200	440	Wagner
50	900	220/440	Westgh
50	720	440	GE-TS
50	300	220/440	Wstg (rotor & stator only)
30	900	440	Wagner
30	600	550	GE (rotor & stator)
30	480	dual	Wtg (rotor & stator)
30	360	550	GE
30	327	220	E-M (rotor & stator)
25	1800	220	Wagner
25	450	220	E-M (rotor & stator)
20	1200	440	Wagner
20	900	220	Wtg
20	600	220	E-M (rotor & stator)



D. C. MOTORS

115 Volts

HP	RPM	Description
225	750	GE-MPC
50	120	Al.Ch.
35	975	Northern
30	1800	F-M
30	200/900	Sprague
25	1150	Triumph
25	750	GE-A
20	1700	Triumph
20	500/1500	GE-RF11
20	400/1200	GE-RLC ft 202A
18	600	Sturtevant MPS
15	1200	J & L
15	1000	GE-CE
15	975	F-M
15	735	Westgh-S ft 6
12	1075	J & L
12	530	Westgh-SK-113
10	3450	Imperial
10	1700	Fairbanks-Mors
10	686	J & L, type CI
10	400/1600	Watson-BW15B

GEAR HEAD MOTORS

60 Cycle, A.C.

HP	Output RPM	Volts	Ph	Description
10	4.90	220/440	3	Master, Vertical
5	6850	220/440	3	Master, Parallel
5	200/1800	220/440	3	Delco, Variable Speed Transmission
3	280	220/440	3	GE, Parallel
3	215/1500	3	3	Master, Vari-Drive
2	6.43	220	3	Master, Parallel
2	315	220/440	3	Master, Parallel
2	281	220/440	3	Master, Parallel
2	157	220/440	3	GE, Parallel
1½	3.4	220	3	Janette, Rt Angle
1½	388	110/220	1	Master, Parallel
1	420	220/440	3	Master, Parallel
1	288	220	3	Master, Parallel
1	2 2 to 11	220/440	3	U.S. Varidrive
1	190	115/230	1	Master, Parallel shaft
½	186	220	3	Cleveland Elec, Parallel
½	269	440	3	Janette-Parallel shaft
1/8	144	230	1	Master, Type RA
1/8	19	220/440	3	Master, PA-TE-BB
1/12	172.5	115	1	Wstgh Rt Angle

D. C. GENERATORS

125 Volts

KW	RPM	Description
540	1000/1300	Westgh, single bearing
500	750	GE-MCF
300	1500	GE-CC
200	900	GE-MPC
200	800	GE-DMC
100	1000	WE-DLC
100	900	Westgh-SK single bearing
85	1600	GE-Type TD
35	116	GE-DLC
35	200	J & L
31.25	1400	Westgh-SK single bearing

D. C. GENERATORS

230 Volts

KW	RPM	Description
400	1200	Westgh, single bearing
200	1200	GE-MPC single bearing
175	450	Westgh
50	1200	Al.Ch.-E-127
35	1800	GE-RC
30	300	Triumph
25	765	Westgh-SK
22½	1750	Delco Ballbearing
20	300	Burke
15	350	Westgh-SK

AC & DC MOTORS • GENERATORS • PUMPS
SYNCHRONOUS MOTORS • CONTROL EQUIPMENT
MOTOR GENERATOR SETS • ELECTRIC EQUIPMENT
STEAM ENGINE GEN. SETS • SLIP RING MOTORS

ELECTRIC CO.

927 HARRIET ST.
PHONE MA. 3024
CINCINNATI 3, OHIO

Puzzled about Buying Power Equipment?

Just remember the

HEMPHILL SEAL

it means equipment

- SELECTED BY EXPERTS
- REBUILT AND TESTED
- UNDER SUPERVISION OF
- HEMPHILL ELECTRICAL ENGINEERS
- GUARANTEED PERFORMANCE

TRANSFORMERS — 60 Cycle

Qu.	KVA	MAKE	TYPE	Ph.	VOLTAGES
1	1000	GE	Auto	3/2	4150 x 2400
1	1000	GE	Auto	3	3810Y-2300Y
1	500	Kuhl.	OISC	1	4600 x 2300V.
3	400	GE	H	1	6900 x 2250V.
1	300	Pitts.	ODSC	1	7800 x 440V.
3	300	GE	H	1	2400 x 120/240
1	200	Whse.	Auto	3/2	4150 x 2300
1	200	Pitts.	OISC	1	4000 x 110/220
1	200	GE	Auto	3/2	4150 x 2400
1	150	GE	KS	1	2300 x 230
1	100	Pitts.		1	2750 x 110/220
3	100	Wagner	RCKV	1	240 x 120/120
2	100	Whse.	SK	1	4400 x 220/440 Taps
2	100	Newark	Dry	3/2	440 x 220
3	100	GE Pyrn.	H	1	4160 x 220/440
3	100	GE	Auto	1	4150 x 2300
1	100	Amer.	OC	1	15000 x 2300
3	75	GE	H	1	2400 x 220/440
3	75	Whse.	SK	1	2400 x 440
7	50	Whse.	SK	1	13750 x 125/250
11	50	GE	H	1	13750 x 125/216
5	50	Whse. Inert.	S	1	4160 x 120/240
2	37½	GE	H	1	2400 x 120/240
2	37½	AC Dry	AD	1	450 x 120
1	37½	Amer.	RS	1	13800 x 220/440
1	37½	GE	H	1	13800 x 220/460
1	37½	Amer.	OISCID	1	13200 x 230/440
3	27½	GE	Dry	1	440 x 230/110
12	25	Whse.	Dry	1	440 x 220/110
1	25	Maloney	Oil	1	230/460 220/110

A.C. GENERATORS
3 Phase, 60 Cycle

Qu.	KVA	MAKE	TYPE	VOLTS	SPEED
1	2500	Whse.		2300	720
1	625	GE	ATB	600	3600
1	375	AC		480	450
1	300	GE	ATB	600	600
1	200	AC		240	3600
1	200	Whse.		240	600
1	225	Whse.		550	514
1	125	GE	ATB	240	600
1	170	Whse.		2200	900
2	50	Whse.		220/440	900
3	44	Columbia		240	1200
1	31	Amer.		120/208	1200
1	18.75	Star		220/440	1800
1	12.5	Whse.		240	1200

D.C. MOTORS

Qu.	HP	MAKE	TYPE	VOLTS	SPEED
1	125	GE	RC	230	1700
1	100	GE	LC	230	875

MOTOR GENERATOR SETS
3 Phase, 60 Cycle

Qu.	KW	MAKE	SPEED	DC	AC
1	1000	Whse.	720	275	2300/4150 Syn.
1	1000	GE	514	600	2300/4150 Syn.
1	500	GE	900	275	2300/4150 Syn.
1	400	GE	900	275	2300/4150 Syn.
1	300	GE	1200	250	2300 Syn.
2	150	GE	1200	125/ 250	2300 Syn.
1	150	Whse.	600	125	4150 Syn.
1	125	CW	1200	125	2300 SC
1	100	CW	1200	125	220/440 SC
1	100	El.Mach.	1200	125	4150 Syn.
2	75	GE	1200	125	220/440 SC
6	75	GE	1200	60	220/440 SC
1	30	Ridgeway	1200	550	220/440 SC
1	50	Whse.	900	250	220/440 SC
2	40	El.Mach.	1750	125	440 SC
1	35	Ideal	1200	125	220/440 SC

OIL CIRCUIT BREAKERS

1—3000	A GE	15000V	3 pole	FK	120
1—3000	A GE	4500V	3 pole	FK	12
2—3000	A GE	600V	3 pole	K	25
1— 600	A Condit	15000V		DR	100
1— 400	A Whse.	37000V		O	221

FLEX ARC WELDER
2—500 Amp. Whse. AC Welder

SPECIAL
1—120 KW 150 KVA Ames Uniflow 16 x 16 220V, 3 ph, Non-Condensing.

NEW CONTROL
4—150 HP GE CR 7051 Sq. Cage Automatic 440V, 3 ph.

LARGE STOCK OF D.C. MOTORS AND GENERATORS, SWITCHBOARD AND CONTROL EQUIPMENT

A.C. MOTORS
3 Phase, 60 Cycle
Synchronous

Qu.	HP	MAKE	TYPE	VOLTS	SPEED
4	200/100	Whse.		4150	720/360
1	200	El.Mach.		2300	360
1	200	GE	TS	440	257
1	185	GE	ATI	2300	720
1	150	GE	TS	220	1800
2	150	AC		2200	360
1	100	GE	ATI	2300	900
1	70	El.Mach.		2300	180
1	35	GE	ATI	2300	1200
1	20	Whse.		220	1800

SLIP RING

Qu.	HP	MAKE	TYPE	VOLTS	SPEED
1	2500	GE	MT	6600	257
1	500	GE	MT	2200	720
1	300	Whse.	CW	440	600
1	250	Whse.	CW	440	600
1	200	Whse.	CW	440	600
1	150	GE	IM	440	450
1	100	GE	IM	440	400
1	75	GE	MT	220	1200 Vert.
1	75	GE	MT	440	900
1	60	GE	MT	220	1200
1	60	GE	MT	440	900
1	50	GE	MT	220	1200
1	50	GE	MT	220	1,200
1	50	Whse.	CW	220	900
1	50	GE	MT	220	1700
1	50	GE	MT	220	600
1	40	GE	MT	220	1200
1	40	GE	MT	2300	1200

SQUIRREL CAGE

Qu.	HP	MAKE	TYPE	VOLTS	SPEED
1	150	CW		2200	1200
1	125	GE	KF	2300	1800
1	125	US		440	1200 Vert.
1	100	LA	RY	440	1800
1	100	Whse.	CS	440	1800
1	75	GE	KF	230/440	1200
1	75	Ideal	AT	230/440	1200
1	60	Whse.	CS	2200	900 Vert.
1	40	GE	KT	220	1200
1	40	Whse.	CS	220	900
1	40/20	Whse.	CS	440	675/435
1	35	Whse.	CS	2200	1200
1	35	GE	IK	550	600
1	30	GE	KT	220	600
1	25	GE	KT	220	1145
1	25	GE	KT	440	1200

JLHCo

THIS SEAL IS YOUR GUARANTEE

"FOR POWER"

J.L. HEMPHILL & CO.

1604 53rd STREET, NORTH BERGEN, N. J.

PHONE NEW YORK—LONGACRE 5-3227

PHONE NEW JERSEY—UNION 3-2600

Our 44th Year

WAGNER

Quality and Service

"CERTIFIED REBUILT"

DEPENDABLE ELECTRICAL EQUIPMENT AT LOW COST

MOTORS . . . GENERATORS . . . M-G SETS

PUMPS . . . FANS . . . BLOWERS . . . SPEED REDUCERS

PARTIAL STOCK LISTING—WRITE, WIRE OR PHONE YOUR REQUIREMENTS

M-G SETS

KW	Mfr.	Input V	Output V
500	Whse.*	2300 AC	250 DC
300	Allis Ch.*	220/440 AC	250 DC
200	Ridgeway*	2300/4000 AC	550 DC
200	Gen.Elec.*	220/440 AC	125 DC
200	Reliance*	220/440 AC	250 DC
150	Gen.Elec.	220/440 AC	125/250 DC
150	Burke*	220/440 AC	250 AC
105	Century b.b.	220/440 AC	70 DC
100	Allis Ch.	220/440 AC	125/250 DC
100	Allis Ch.	2200 AC	250 DC
100	Gen.Elec.*	220/440 AC	125 DC
75	Gen.Elec.(3)	220/440 AC	125 DC
75	Cr.Wh. b.b.(2)	220/440 AC	250 DC
75	Star*b.b. NEW	220/440 AC	250 DC
50	Whse.	220/440 AC	250 DC
50	Gen.Elec.(2)	220/440 AC	125 DC
40	Northw'n Conv.	220 AC	230 DC
35	Gen.Elec.	220/440 AC	48 DC
32	Gen.Elec.	220/440 AC	180 cycle
30	Gen.Elec.	220/440 AC	250 DC
25	Gen.Elec.	220/440 AC	25 DC
20	Whse.	230 DC	110 AC
20	Star b.b.(2)	220/440 AC	250 DC
15	Gen.Elec.	220/440 AC	125 DC
10	Allis Ch.(2)	220/440 AC	250 DC

*Synch. motor drive.

D. C. MOTORS

HP	Mfr	Type	Volts	Speed
250	Al.Ch. New	EBL-149	230	1750
200	Reliance	1970T	230	575/750
150	Whse.	SK201	230	300/900
140	Cr.Wheeler b.b.	52H	230	1200
140	Cr.Wheeler b.b.	TEFC	230	800
100	Whse.	SK181	230	440/900
100	Gen.Elec.	C	230	575/1000
100	Gen.Elec.	RC36	115	1150
75	Cr.Wh. NEW b.b.	TEFC	230	900
75	Allis Ch.	E-149	230	500
75	Northw'n	K20	230	1750
75	Cr.Wh. New b.b.	CMC-HH	230	1150
75	Century	DN	230	850
60	Century	DN	230	1150
50	Cr.Wheeler	FH	230	1750
50	Gen.Elec. b.b.	CDM	115	1150
40/60	Whse.(2)	SK170	230	500/1000
40	Cr.Wheeler	EH	230	1750
40	Century(2)	DN	230	1150
40	Sprague dyna.	LC	230	750/2000
40	Whse.(2)	SK120	230	950
35/50	Gen.Elec.	CD122	230	575/1150
30	Reliance b.b.(3)	230T	230	850
30	Whse.	SK93	230	1750
25	Gen.Elec.	RC31	230	1150
25	Gen.Elec.	CD85	230	1750
20	Gen.Elec.	RF12	230	400/1600
20	Whse.	SK93	230	1150
20	Gen.Elec.	CD85	230	1150
20	Whse.	SK120	230	800/1600
20	Reliance b.b.	TE	230	850
15	El.Dyn. b.b.	326	230	1750
15	El.Dyn. b.b.	186	230	800/1300
15	Whse.(2)	SK80L	230	1150
15	G.E. TEFC b.b.	CD83	230	1750

D. C. GENERATORS

KW	Mfr.	Type	Volts	Speed
200	Reliance	1970T	250	720
150	Cr.Wheeler b.b.	TEFC	250	1200
125	Cr.Wheeler b.b.	52H	250	1200
105	Century b.b.	1500 amp.	70	1200
100	Gen.Elec.	RC17	125	1200
100	Gen.Elec.	C	250	750
100	Allis Ch. 3 wire	MCW	120/240	1200
75	Cr.Wh. New b.b.(3)	HH	250	1450
75	Allis Ch.	E	250	750
75	Gen.Elec.(3)	RC36	125	1200
50	Whse.	SK	250	1200
50	Gen.Elec. b.b.	CDM	125	1450
40	Whse.	SK	250	1150
35	Northw'n	K	125	1150
30	Elec.Prod.(2)	BP	50	1150
25	Gen.Elec. b.b.	CDM95	25	1200
20	Whse	SK93	250	1750
15	Star b.b.(4)	SQ	250	1750

A. C. MOTORS—25 CYCLE

HP	Mfr.	Type	Volts	Speed
150	Whse.	HF	440	500
150	Gen.Elec.	IK-16	440	750
50	Gen.Elec. Int.	MTC5337	440	750
50	Gen.Elec.	I-K	440	750
50	Gen.Elec.	KT339	440	1200
40	Gen.Elec.	KT343	440	750
20	Gen.Elec.	KT537	440	750

A. C. GENERATORS—60 CYCLE

KVA	Mfr.	Type	Volts	Speed
625	Gen.Elec.	ATB	2300	450
375	Gen.Elec.	ATB7567	240/480	1200
300	Gen.Elec.	ATB	240/480	720
250	Whse.	G	2400/480	600
225	Gen.Elec.	ATB	240/480	600
187	Gen.Elec.(2)	ATB	240/480	900
150	Gen.Elec.	ATB	240/480	900
125	Gen.Elec.	ATB	240/480	720
125	Gen.Elec.	ATB	240/480	300
56	Gen.Elec. (2)	ATB	240/480	1200
56	Gen.Elec.	ATB	240/480	900
31	Gen.Elec.	AT17536	240/480	1200
31	Whse.b.b.	G	120/208	1200
28	F.Morse	AB	220/440	1800
25	Whse b.b.	1 ph.	120/240	900

A. C. MOTORS—SLIP RING

3 Phase 60 Cycle 220 or 440 Volts

Qu.	HP	Mfr.	Type	Speed
1—	600	Gen.Elec.	I-M	360
1—	500	Allis Ch.	ANY	450
1—	400	Gen.Elec. 2300V.	UM-EB	1800
2—	300	Allis Ch. 2300V.	ANY	720
1—	300	Gen.Elec. 2300V.	I-M	1800
1—	250	Gen.Elec.	I-M	600
1—	250	Allis Ch. 2300V.	ANY	514
2—	200	Gen.Elec. 2200V	I-M-16	600
1—	200	Gen.Elec.	I-M	360
1—	200	Gen.Elec.	I-M-17	600
1—	200	Gen.Elec. 2200V.	I-M-17A	450
1—	200	Allis Ch. 2200V.	ANY	720
1—	150	Gen.Elec. 2200V.	I-M-16	600
1—	150	Whse.	MW	450
1—	150	G.E. 2200/4000V.	I-M	1200
1—	150	Allis Ch.	ANY	600
1—	100	Gen.Elec.	MT356	900
1—	100	Gen.Elec.	I-M	720
1—	100	Allis Ch.	ANY	1800
1—	100	Allis Ch. b.b. NEW	ARY	600
1—	75	Howell	SR443	1800
1—	75	Cont. b.b. New	SN534	1200
1—	75	Gen.Elec.	I-M-E13	1200
2—	75	Gen.Elec.	I-M-14	720
1—	75	Gen.Elec. int. duty	MTC5342	900
1—	75	Gen.Elec.	MT558	600
1—	50	Allis Ch.	ANY	900
1—	50	Howell	SR437	1200
1—	50	Fair.Morse	BV	720
1—	50	Gen.Elec. int.	ITC5013	600
1—	50	Whse. int.	CI	600
1—	50	Gen.Elec.	I-M	720
1—	40	Gen.Elec. int.	MTC5526	900
1—	17	Gen.Elec. int.	ITC	600
3—	30	Gen.Elec.	MT332	900
1—	30	Gen.Elec.	OMT326	1200
1—	30	Gen.Elec.	MT346	600
1—	25	Whse.	CW	1200
1—	25	Gen.Elec.	MT526	900
1—	25	Triumph	SR	1200
1—	25	Gen.Elec.	I-M	600
2—	20	Gen.Elec. int.	MTC5512	900
1—	20	Gen.Elec.	MT563	1800
12—	10	Reliance New b.b.	AW-324	1800

A. C. MOTORS—SYNCHRONOUS

HP	Mfr.	Type	Volts	Speed
600	Gen.Elec.(2)	TS	2200	514
400	Gen.Elec. .8PF	TS	220/440	1200
300	Gen.Elec.	ATI	220/440	720
300	Whse.	G	2200/440	600
225	El.Machy.	3 brg.	2200	360
220	G.E. 3 brg .8PF	ATI	220/440	600
200	G.E. .8PF	ATI	220/440	900
190	El.Machy	3 brg.	220/440	514
150	Gen.Elec.	ATI	220/440	300
180	Gen.Elec.(2)	ATI	220/440	720
100	American b.b.	YGH	220/440	900

- EXPLOSION PROOF MOTORS — New & Rebuilt, all sizes.
- GEARHEAD MOTORS, AC & DC.
- FREQUENCY CHANGERS.
- CIRCUIT BREAKERS, AC & DC.

A. C. MOTORS—SQUIRREL CAGE

3 Phase 60 Cycle 220 or 440 Volts

Qu.	H.P.	Mfr.	Type	Speed
1—	400	Whse. 2200V.	C8	1800
1—	300	Gen.Elec.b.b.	K559	1200
1—	250	Gen.Elec.	PT549AZ	3600
1—	250	Gen.Elec.	PT549	3600
1—	250	Whse.	C8954A	720
1—	200	Whse. b.b. NEW	C8875	1800
1—	200	Allis Ch.	AN	1200
1—	150	Gen.Elec. TEFC b.b.	K6333S	1200
2—	150	Howell b.b.	M584	1800
1—	150	Gen.Elec.	I-K-16	600
1—	150	Reliance b.b. NEW	B6085	1200
2—	150	Gen.Elec.	KF557	1200
1—	150	Gen.Elec.TEFC b.b.	K6335	720
2—	125	Gen.Elec.	K505S	1800
1—	125	Reliance b.b. NEW	C5085	1200
1—	125	Allis Ch. 2200V.	AN	1200
1—	125	Gen.Elec.	I-K-16	450
1—	125	Cont. 2200V. b.b.	SC	1800
2—	125	Rel. TEFC NEW	B6085	1800
1—	100	Gen.Elec.	I-K-14	900
5—	100	Allis Ch. 2300V.	AR226	1200
1—	100	Reliance b.b. NEW	C5085	900
1—	100	Rel. TEFC NEW	C5085	1200
1—	100	Gen.Elec. b.b. NEW	K5043	1800
1—	100	Cont. TEFC	NP583	1200
1—	100	Gen.Elec.	I-K-J	720
2—	75	Gen.Elec.	I-K	600
1—	75	Gen.Elec.	I-K-14	720
1—	75	Reliance b.b. NEW	C5084	900
1—	75	Reliance TEFC NEW	C5084	1200
1—	75	Reliance b.b. NEW	C505	1800
1—	75	Gen.Elec.	KT329Y	3600
2—	75	Reliance b.b. NEW	C505	1200
1—	60	Al.Ch. 2200V.	AR226C	900
1—	60	Gen.Elec.	KT532	720
2—	60	Reliance b.b. NEW	B504	1800
2—	60	Reliance TEFC NEW	C505	1200
2—	60	Reliance b.b. NEW	C504	1200
2—	60	Whse.H.T.	C8504	1800
1—	60	Wagner b.b.	RF444	3600
1—	50	Allis Ch. b.b.	ARX445	1800
1—	50	Whse. b.b. NEW	C8405S	1800
1—	50	G.E. NEW b.b. HT	KG405	1800
2—	50	Reliance b.b. NEW	C445	1200
2—	50	Gen.Elec.	KT336	1200
1—	50	Gen.Elec.	KT342	900
1—	50	Whse. hislip	WL607	900
1—	50	Whse. b.b.	CS504	1200
2—	50	Gen.Elec.	KT352	600
2—	40	Gen.Elec. b.b.	KP504	900
1—	40	Gen.Elec. b.b.	KF404S	3600
2—	40	Gen.Elec.	KT537	1800
1—	40	Al.Ch. 3 speed	ARX	900/600/450
4—	40	Gen.Elec.	KT336	900
2—	40	Reliance b.b. NEW	C404	1800
2—	40	Reliance TEFC NEW	C445	1200
3—	40	Gen.Elec	KT532	1200
2—	30	Gen.Elec.	KT342	600
2—	30	Gen.Elec.	KT532	900
1—	30	Al.Ch. TEFC b.b.	ARZ445	900
2—	30	Howell b.b. 4 speed	SC	1800
2—	30	Gen.Elec. NEW hitorq.	KG365	1800
2—	30	Gen.Elec. TEFC b.b.	K404	1800
1—	30	Gen.Elec	KT336	720
2—	30	Reliance b.b. NEW	C405	1200
2—	30	Reliance TEFC NEW	C444	1200
3—	25	Reliance TEFC NEW	C444	900
3—	25	Reliance b.b. NEW	C364	1800
2—	25	Reliance TEFC NEW	B365	1800
2—	25	Reliance b.b. NEW	C404	1200
2—	25	Reliance TEFC NEW	C405	1200
2—	25	Whse. NEW spl. b.b.	CS365	1800
3—	25	Whse.	CS646	900

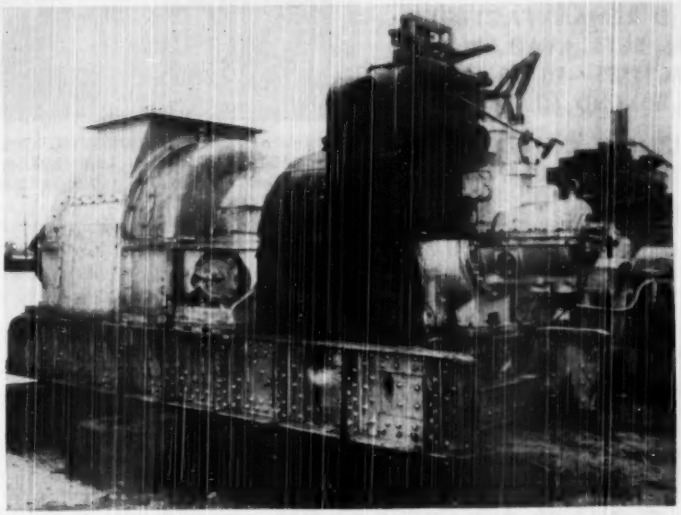
ARTHUR WAGNER COMPANY

1335 W. RANDOLPH STREET | CHICAGO 7, ILL. | MONroe 6-7409

IMMEDIATELY AVAILABLE

2500-KVA Westinghouse

Condensing Turbo-Generator: 250-psi 3/60/2300-v



The 2500-KVA., Westinghouse Condensing Turbo-Generator Turbine Serial 12567 illustrated above, is a high grade machine, in good condition, ready for installation. It is a complete unit with Westinghouse 2-pass Surface Condenser, with auxiliaries, Serial No. 2704, with Switchboard complete with all instruments, etc.

SPECIFICATIONS

Turbine		Generator	
Mfr.	Westinghouse	Mfr.	Westinghouse
Capacity	2500-KVA	Capacity	2500-KVA
Steam	250-psi	Frequency	3/60/2300-v
RPM	3600	RPM	3600
Vacuum	28"	Power Factor	100%
Frame	26-FCW	Amps	655
Serial No.	12567	Serial No.	4782722

OTHER TURBO-GENERATORS IN OUR STOCK

6250-KVA., G.E., 2300/4160v. Cond.
4375-KVA., G.E., Rebuilt: New Coils
3125-KVA., G.E., Complete, 250#
3125-KVA., West., 250#, 2300v. Cond.
2500-KVA., West., Non-C., 250# (2)
2500-KVA., G.E., 150#, Cond. 2300v
1875-KVA., G.E., 250-psi., No. 1 unit
1875-KVA., Allis-C., Cond., 200#, 2300v
1563-KVA., G.E., 200-psi. Non-C., 15/25-BP
1563-KVA., G.E., 225-psi. Cond., 2300v
937-KVA., G.E., 150-psi. Non-C., 480v, 15-BP
937-KVA., Allis-C., Cond., 480v
937-KVA., G.E., Cond., Rebuilt
625-KVA., West., Non-C., 300#-psi, 480v, 15/25-BP
625-KVA., G.E., Cond., 200-psi. 480v
625-KVA. (2), G.E., Non-C., 480v, 150#, 15/25-BP
625-KVA. (2), DeLaval-Allis, 125#, 480v, 15/25-BP

COMPLETE DATA ON REQUEST. PLEASE SEND SPECIFICATIONS FOR ANY ITEM WANTED NOT LISTED.

We Specialize also in Diesel Engines: Carry a Complete Line: Also Boilers

Send for Bulletins 320, 350 and 525. CORRESPONDENCE INVITED

TELEPHONE
WRITE OR
WIRE

CHARLES WEAVER

Electrical-Mechanical Engineers
4145 Penobscot Building
DETROIT 26, MICHIGAN

TELEPHONES
WO 1-1340
WO 1-1341
WO 1-6038

ALWAYS GET WEAVER'S MONEY • SAVING PRICES BEFORE BUYING

DIESEL POWER

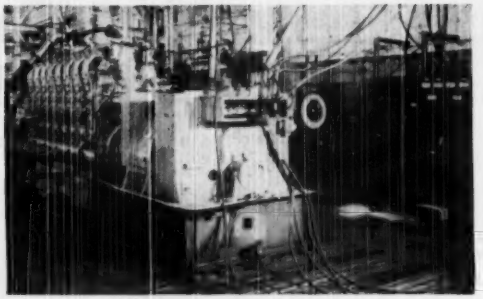
FOR

IMMEDIATE SHIPMENT

•

NEW AND REMANUFACTURED DIESEL SETS AVAILABLE
UNIT CAPACITIES—10 TO 1875 KVA
A.C.—50 AND 60 CYCLES

ALL EQUIPMENT OFFERED WITH ONE YEAR GUARANTEE



VIEW OF ENGINE TEST STAND FACILITIES AT OUR PLANT IN SAUSALITO (S.F.), CALIF. ALL UNITS ARE REMANUFACTURED AND FULL-LOAD TESTED PRIOR TO SHIPMENT.

A PARTIAL LIST OF OUR INVENTORY

KVA	MAKE	MODEL	HP	RPM	KVA	MAKE	MODEL	HP	RPM
1875	Fairbanks Morse	33E16	2000	300	312.5	Clark	MD-4	375	327
1420	Fairbanks Morse	38D	1600	720	300	Fairbanks Morse	YVA	360	257
1250	General Motors	16-278A	1600	720	250	General Motors	8-268A	350	1200
1000	General Motors	12-278A	1200	720	200	Buckeye	80	240	600
937.5	General Motors	12-567	1080	720	187.5	Ingersoll Rand	S	225	514
625	Alco	6-12½x13T	750	600	156	Buckeye	E	190	400
425	Baldwin	VO	510	450	125	General Motors	3-268A	150	1200
400	Buckeye	80	480	600	121	Fairbanks Morse	32E14	140	300
375	Enterprise	DSG-6	450	450	75	General Motors	6-71	90	1200
330	Superior	KNA	396	514	62.5	Int'l Harvester	UD-18	76	1200
312.5	General Motors	8-268A	450	1200	50	General Motors	4-71	60	1200

A. G. SCHOONMAKER COMPANY, INC.

52 CHURCH STREET, NEW YORK 7, N. Y.

SHOPS AND WAREHOUSE: JERSEY CITY, N. J. AND SAUSALITO (S.F.) CALIFORNIA

FOR SALE

2 RILEY-JONES STOKERS—Type AR

With all accessories — underfeed, single retort, side dumping.

Width between side walls 6 ft. 6 in. Length from inside front wall to face of bridgewall 6 ft. 4½ in. Equipped with Riley-Jones Riflex Mechanical drive consisting of a highly efficient spur gear reduction unit operating a ram with a simple timing mechanism to vary the interval between ram strokes, thus giving a quick full stroke of the ram at all rates of feed. Stokers are of the unit type driven from fan motor through silent chain drive. This was stand-by equipment and is in excellent condition and available for inspection at warehouse in Bayonne.

PHARMA CHEMICAL CORPORATION
Bayonne, New Jersey

STEEL STORAGE TANKS

2—1000 & 2—10,000 Bbl. New Vertical
6—74,000, 55,000 & 37,500 Bbl. Vert.
8—25,000 Gal. Cap. Horizontal
30—10,000 & 3—20,000 Gal. Horizontal
6—10,000 & 12,000 & 16,000 Gal. ⅜" Shell
20—10,000 Gal. Cap. 60 lbs. Press. Test

L. M. STANHOPE, Rosemont, Penna.

SELLING FOR CUSTOMERS

1500 KW 4000 V Allis Chalmers Cond turbine 200 lb. 5 lb. B. P.
300 KW 240 V Westinghouse geared Noncond. turbine
400 KW 480 V 1200 RPM Elliott generator with 1200/4500 gear.
285 KVA 240 V Chuse uniflow engine set.
2000 Amp. 3-pole GE Air breaker with Bus Duct.
300 & 200 KW Syn M.G. Set with control.

H. BLANE JOHNSON & ASSOCIATES
53 W. JACKSON BLVD., CHICAGO 4, ILL.

TRANSFORMERS FOR SALE

3—1000 KVA A-Ch 13800-2400
3—500 KVA G-E 2400-240/480
3—500 KVA G-E 11500-2300/4000Y
1—400 KVA G-E 13200-120/240
3—333 KVA G-E 33000-2300/4000Y
3—333 KVA G-E 13800-120/240
3—333 KVA G-E 13800-230/460
3—333 KVA G-E 11000-2300/4000Y
3—333 KVA G-E 2400/4160Y-240/480
1—250 KVA G-E 6900/11950Y-230/460
3—200 KVA G-E 6900/11950Y-230/460
3—200 KVA G-E 6600/11430Y-2300
3—150 KVA G-E 22000-2300/4000Y
3—150 KVA G-E 11000-2300/4000Y
3—150 KVA G-E 6900-460/230
3—150 KVA L-M 2400/4160Y-120/240

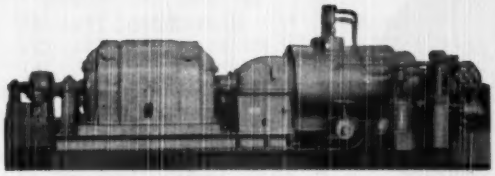
Many other items in stock

TRANSFORMERS WANTED

Reliable rewind and repair services on all makes of transformers

THE ELECTRIC SERVICE CO.
Cincinnati 27, Ohio

POWER PLANT MACHINERY



2500 KVA ALLIS CHALMERS CONDENSING TURBO UNIT

2000 KW 80% P.F. 2500 KVA Allis Chalmers Generator, 3 phase 60 cycle 4160/2300/600/480 volts, direct connected to 2000 KW Allis Chalmers condensing turbine, 250-400# steam pressure, 650° TT, 3600 RPM.

Equipped with direct connected exciter, surface condenser and auxiliaries.

This unit is designed for high efficiency. The full load steam consumption is approximately 11# steam per KW hour.

New 1933 — Excellent Condition.

UNIFLOW UNITS—3 phase 60 cycle

750 KVA Ames Vertical, 150# steam, 5# exhaust, 4000/2300/480 volts.
625 KVA Skinner, 150# steam, 5# exhaust, 240/480 volts.
500 KVA Skinner, 150# steam, 5# exhaust, 2300/480 volts.
375 KVA Skinner, 150# steam, 5# exhaust, 4000/2300/480 volts.
312 KVA Skinner, 150# steam, 5# exhaust, 2300/480 volts.
250 KVA Skinner, 150# steam, 5# exhaust, 480 volts.
250 KVA Ames Vertical, 150# steam, 5# exhaust, 480 volts.
188 KVA Ames Vertical, 150# steam, 5# exhaust, 480 volts.
187 KVA Skinner, 150# steam, 5# exhaust, 2300 volts.
175 KVA Skinner, 150# steam, 5# exhaust, 240 volts.

DIESEL UNITS—3 phase 60 cycle

1250 KVA Fairbanks-Morse, 2300 volts, 720 RPM.
450 KVA (3) Alco, 480 volts, 514 RPM.
375 KVA Fairbanks-Morse, 2300 volts, 300 RPM.
250 KVA (2) Fairbanks-Morse, 2400/4160 volts, 300 RPM.
187 KVA (3) Buckeye, 240/480 volts, 400 RPM.
150 KVA Fairbanks-Morse, 240 volts, 257 RPM.
93 KVA (3) Cooper Bessemer, 220 volts, 400 RPM.

TURBINE GENERATOR UNITS
3 phase 60 cycle

6250 KVA Allis condensing, 200# steam, 2400/4160 volts.
5000 KVA G. E. non-condensing, 600# steam, 50# exhaust, 150# extraction, 13,800/6900/4000 volts.
4375 KVA G. E. condensing, 200# steam, 2300 volts.
3750 KVA Allis condensing, 250# steam, 480 volts.
3125 KVA West. condensing, 175# steam, 25# extraction, 2300 volts.
2500 KVA (2) Moore condensing, 200# steam, 15# extraction, 2300/4600 volts.
2250 KVA (2) G. E. condensing, 400# steam, 2300 volts.
1875 KVA Allis condensing, 200# steam, 2300 volts.
1563 KVA G. E. non-condensing, 250# steam, 20# exhaust, 2300 volts.
1250 KVA West. condensing, 200# steam, 10# extraction, 480 volts.
1250 KVA G. E. condensing, 150# steam, 10# extraction, 2300 volts.
1250 KVA West. condensing, 450# steam, 2300/4150 volts.
938 KVA Allis non-condensing, 125# steam, 20# exhaust, 480 volts.
938 KVA Allis condensing, 150# steam, 5# extraction, 480 volts.
937 KVA G. E. condensing, 175# steam, 15# extraction, 2300 volts.
625 KVA West. non-condensing, 200# steam, 5# exhaust, 480 volts.
625 KVA Terry non-condensing, 250# steam, 25# exhaust, 480 volts.
625 KVA G. E. non-condensing, 150# steam, 50# exhaust, 2300 volts.
625 KVA Moore condensing, 175# steam, 15# extraction, 2300 volts.

BOILERS

60,000# (2) Comb. Eng. 450#, chain grate stoker.
50,000# B & W, 300#, pulverized coal.
40,000# Vogt 450#, chain grate stoker.
30,000# Comb. Eng. 450#, spreader type stoker.
10,000# Keeler 250#, spreader type stoker.

SURFACE CONDENSER

12,500 Sq. Ft. Wheeler, two pass with auxiliaries.

Send for our Latest List of Power Plant Machinery.

INTERNATIONAL POWER MACHINERY CO.

UNION COMMERCE BLDG. **Telephone: MAin 9514** **CLEVELAND 14, OHIO**

MOTORS - M.G. SETS - CONTROLS

AT REDUCED PRICES!

M-G SETS

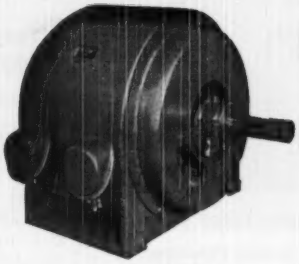
KW	D.C. Volts	A.C. Volts	Mfg.
500	250	2200	C-W
400	125/250	2300	Ideal
300	250	2200	G.E.
300	125/250	440/2300	Allis (New)
200	250	2200	Whse.
200	125/250	2200	G.E.
150	250	440	G.E.
125	230	440	Whse.
100	250	220/440	Star (New)
75	250	440	C-W
60	250	220	G.E.
50	250	440	Whse.

Reconditioned and guaranteed

NEW SYNCHRONOUS
500 HP, 600 RPM, Electric Machinery, 2300 V., 3 Ph., 60 Cy., 80% P.F. Pedestal Sleeve Bearing, with Base, Double Shaft—Short, complete with E-M Magnetic Controller.

SYNCHRONOUS

HP	RPM	Volts	Mfg.	Type
800	150	440	G.E.	80%
650	138	2300	Whse.	Engine
600	450	2300	G.E.	80%
500	514	440	E-M	100%
400	900	2300	Whse.	80%
400	720	440	G.E.	80%
400	600	440	G.E.	100%
400	514	440	G.E.	100%
350	900	440	G.E.	100%
350	200	2300	Whse.	100%
300	514	440	G.E.	100%
250	600	4160	E-M	100%
150	900	4160	G.E.	80%
75	900	220	E-M	80%



SLIP RING

New 1250 HP 720 RPM G.E. MT 2300/3/60 Slip Ring Motor, with Hyd. Coupling and Magnetic Control.

2—New 500 HP, 1200 RPM Elliott, 220/440 V., 3 Ph., 60 Cy., Shaft 4½" dia. x 8" long. (Photo above.) Control Available.

NEW SLIP RING CONTROLS
10—250 HP 440/3/60 Fully Magnetic, Reversing, 7 steps acceleration, Allis-Chalmers, with air ckt. brkr. Open or enclosed.

NEW DIRECT CURRENT

230 Volt Drip proof — ball bearing

Qu.	HP	RPM	Mfg.	Frame
5	250	1750	A-C	149
1	75	400/1200	Rel.	651-T
2	30	850/1700	Rel.	230-T
3	10	1750	Rel.	34-T
1	10	575/2300	L.A.	Ball
5	7½	575/2300	G.E.	77-CD

Reconditioned and guaranteed
230 VOLTS D.C.

HP	RPM	Mfg.	Brg.
250	400/1200	E-D	Ball
200	300/900	Whse.	Ped.
200	400/1200	Rel.	Ball
150	300/1050	C-W	Ball
125	400/1200	G.E.	Slv.
125	300/900	Rel.	Slv.
100	500/1500	C-W	Ball
100	475/1350	E-D	Slv.
75	500/1500	C-W	Ball
60	400/1200	Whse.	Slv.
50	350/1050	Whse.	Ball
40	400/1600	Rel.	Ball

SLIP RING — R & G.

HP	RPM	Volts	Mfg.
700	720	2300	Allis
500	450	2300	G.E.
450	514	440	Whse.
350	900	2300	Whse.
350	450	2300	Whse.
250	900	440	Whse.
200	1200	440	G.E.
150	900	2300	C-W
125	900	440	Whse.
125	720	440	E-M
100	600	2200	A-C

Buy from BOSWICK with confidence

WAlbridge 1195

BOSWICK ELECTRIC CO.

P.O. BOX 55 — AKRON 9, OHIO

NORTHERN METAL CO. — MACHINERY at REDUCED PRICES

DIESEL GENERATORS

100 K.W. Allis Chalmers. 1944. 3/60/120/450.
Exciter: 3 K.W. 120 V. D.C.
Diesel Engine: Lorimer. Model F5SS. 150 H.P. 7½"x9½".
5 cylinder. with electric starting motor.

MOTORS

Westinghouse. 1944. Synchronous—Induction.
60 Pole. 3300 S.H.P. 3 Phase. 82.5 Cycles. 2200 Volts.
165 R.P.M. Power Factor 100%.
Exciter: 125 Volts D.C. Load Factor 100%. 1944.

BOILERS

WATER TUBE. Babcock & Wilcox. 1945. 2 Drum, Bent Tube, Economisers, Internal Desuperheater. Superheaters. W.P. 400 P.S.I. Hydrostatic Press. 718 P.S.I. Heating Surfaces: 2441 sq. ft. Superheater 350 sq. ft. Economiser 1620 sq. ft. 3 Todd "Hex Press" Fuel Oil Burners. Diamond Soot Blowers. Auxiliaries available.

NUMEROUS OTHER ITEMS ARE AVAILABLE

MILNOR & BLEIGH STS. • PHILA. 35, PA.
Phone MAyfair 4-1400

Compressors — Vacuum Pumps
A Good Name to Go Buy
"AMERICAN"
REBUILT — GUARANTEED
SAVE 40%-60%
The World's Best, Since 1902
All Makes — All Sizes
Air Cooled — Water Cooled
Stationary or Portable
Motor — Steam — Gas — Diesel

HOW ABOUT A STANDBY UNIT??
CHEAP INSURANCE

American Air Compressor Corp.
Dell Ave. & 47th St., North Bergen, N. J.
SINCE 1902

NEW and REBUILT
MOTORS
GENERATORS
TRANSFORMERS
1 to 1500 H. P.
ELECTRIC EQUIPMENT CO.
ROCHESTER 1, NEW YORK
Write For Free 1950 Catalog

MOTOR GENERATORS

1—500 KW G.E. Syn. 250 V. 900 RPM
1—400 KW WEST. Syn. 600 V. 720 RPM
2—300 KW G.E. Syn. 250 V. 1200 RPM
1—200 KW G.E. Syn. 250 V. 1200 RPM
1—150 KW G.E. Syn. 250 V. 1200 RPM

ROTARY CONVERTERS

1—300 KW G.E. Syn. 600 V. HCC 1200 RPM
2—150 KW G.E. Syn. 250 V. HCC 1200 RPM

GENERATORS & ARMATURES

2— 50 KW G.E. 600 V. DLC 1200 RPM Gen.
1—500 KW G.E. 250 V. MPC 900 RPM Arm.
1—300 KW G.E. 250 V. HCC 1200 RPM Arm.

TRANSFORMERS

3—100 KVA G.E. 2300/4400/7620—220/440, 2300/4600/8000—230/460, 2400/4800/8320—240/480

WALLACE E. KIRK COMPANY
502 Grant Bldg., Pittsburgh 19, Pa.

DIESEL GENERATOR SET!

225 HP Busch Sulzer Model DF, 3 cyl., 4 cycle, solid injection, 360 RPM. Direct erator with direct connected exciter, air connected 150 KW 3/60/2300 volt gen-filter, muffler, etc. A modern unit in perfect condition only $4000 f.o.b. St. Louis.

MISSISSIPPI VALLEY EQUIPMENT CO.
507 Locust St. St. Louis 1, Mo.

ELECTRICAL CABLE

- for every industrial and power application
- Special constructions. Odd lengths.
- Large stocks on hand of High voltage, lead covered cables not ordinarily stocked by your regular suppliers.
- Cut to length. Reasonably priced.

UNIVERSAL WIRE AND CABLE CO.
2668 N. Clybourn Ave., Chicago 14, Ill.

LARGE QUANTITY

NEW ILG MARINE BLOWER FANS 24"—6250 C.F.M. 33"—10000 C.F.M. 36"—15000 C.F.M. Axial Flow—Propeller Type. Driven by 230 Volt D.C. Motors.

ELECTRIC APPARATUS REPAIR CO.
1400 N. 6th St. Phila. 22, Pa.

FOR SALE

Four new Onan Electric Plants, Model WC 825-S, 3 phase, 60 cycles, 480 volts, 25.3(40 amps), driven by 6 cylinder gasoline engine with 12/6 volt d.c. exciter built in, complete with switchboard.

THE EASTERN MACHINERY COMPANY
1003 Tennessee Ave. Cincinnati, Ohio
Telephone Melrose 1241

M. G. SET: G. E., 3 phase, 60 cycle, 220 volt, 20 H.P., D.C. Generator, 12 KW, 125 volt, with push button compensator.

MOTORS: 2—NEW 1000 H.P., 3 phase, 60 cycle, 2200 volt, complete with automatic control equipment.

TRANSFORMERS: 2—2500 KW, 3 phase, 60 cycle, 66,000 to 2300 volts. A complete Sub-Station.

COAL PULVERIZER: NEW, UNUSED, Babcock & Wilcox, capacity 7500 lbs. of coal per hour, 125 H.P. motor, complete.

COAL DRYERS: Ruggles Coles 90" x 60 ft., class XF14. Ruggles Coles 80" x 60 ft., class XF12. Traylor 54" x 40 ft.

A. J. O'NEILL
LANSDOWNE, PA.
Phila. Phones. Madison 3-8300—3-8301

ELECTRICAL EQUIPMENT — REBUILT and GUARANTEED

MOTORS—GENERATORS—MG SETS—TRANSFORMERS—CONTROLS

WRITE FOR NEW STOCK LIST No. 1622

VARIABLE VOLTAGE DRIVES

40 HP Reliance Variable Voltage Drives, each Consisting of:
1—40 KW 250 Volt. Induction M-G Set, with two auxiliary 3 KW generators and exciter.
1—40 HP 460/1500 RPM, Frame 383T, 230 Volt, DC Motor.
With full magnetic control providing log forward, log reverse, run, fast, slow, and stop, and motor operated field rheostat.

SLIP RING MOTORS—3 Ph., 60 Cy.

Qn.	H.P.	Speed	Volts	Make	Type
6	7½	510	550	G.E.	MTC-5201
2	10	1140	440	West.	HF-7A
2	10	870	220	G.E.	RH-11
2	11½	820	550	G.E.	ITC-5008
2	15	1150	440	West.	CW-464C
2	15	570	220	West.	CW-646
1	18	680	440	West.	MW-316
1	20	860	440	West.	CW-638
1	25	1130	550	G.E.	MT-323
1	25	350	220	Wagner	BR
2	25	720	440	Wagner	22VBR
1	30	865	440	West.	CW-646
1	30	350	440	G.E.	MT-332
1	30	677	440	G.E.	MT-336
2	35	600	440	F-M	HV-H16A
2	40	865	2200	ALCh.	ARY-223C
1	40	560	440	G.E.	MT-346
2	50	1150	440	G.E.	M-536
1	50	860	440	West.	HF-12A
1	50	570	440	G.E.	MT-552
5	52½	550	220	G.E.	MQC-5013 ***
1	60	685	440	West.	CW-768
1	60	570	550	G.E.	MTC-5546
1	60	345	550	West.	CW-938
1	80‡	575	440	G.E.	MTC-5352
2	125	430	440	G.E.	IL-16
2	150	1750	440	G.E.	MTP-549
1	175	505	550	West.	CW-1002
2	200	600	550	G.E.	IM-17
1	200	495	2200	G.E.	IM-17A
3	300	900	440	G.E.	IM-17
2	300	880	2200	G.E.	IM-17A
4	350	1775	2300	G.E.	IM-E15A
2	350	880	2200	G.E.	IM-17A
1	400	505	550	West.	CW
1	600	1770	440	G.E.	IM-E15C
1	650**	360	440	G.E.	MT-442Y
1	700	735	4000‡‡	West.	CW

220 volt motors can be reconnected for 440 volts.
‡ Intermittent rating. *** 2 phase.
** New. ‡‡ 25 cycle.

A.C. GENERATORS — NEW

3 Phase, 60 Cycle, 0.8 P.F., Two Bearing, with Damper Winding and Direct Connected Exciter.

Quan.	KVA	RPM	Make	Volts
4	18.7	1800	Columbia	240/120
5	18.7	1800	Columbia	208/120

230 VOLT CONST. SPEED D. C. MOTORS

Qn.	H.P.	Speed	Make	Type
10	⅞	850	Reliance	Y-23T
25	3½	850	West.	SK-30
1	7½	1150	G.E.	CDM-65
2	7½	850	G.E.	CD-75
10	10**	1750	Kimble	BA-324
5	10**	1150	ALCh.	EB-80
2	10	850	West.	SK-83
10	13½**	600	West.	SK-03
3	15	1750	G.E.	CD-75
5	15	825	West.	SK-90
1	20	1750	L.A.	ONA-L851
1	20	1750/1310	West.	SK-83
2	20	1150	G.E.	RC-30
11	20	750	West.	SK-1101
17	25	825	West.	SK-120
1	30	1100	G.E.	RC-12
1	40	1700	West.	SK-103
1	40	750	G.E.	RC-34
1	50	750	West.	SK-150
1	50	650	G.E.	RC-16
1	60	1750/1310	West.	SK-143
1	150	700	ALCh.	
2	200	1150	G.E.	RC-38
1	250	1150	C.W.	CMC-101A

230 VOLT ADJ. SPEED D. C. MOTORS

Qn.	H.P.	Speed	Make	Type
6	5/7½	600/1800	G.E.	RA-30
1	10	400/1600	Reliance	T-92T
2	10/15	600/2400	Reliance	T-92T
1	12½	250/340	West.	SK-130
10	12½**	600	West.	SK-03
1	15	600/1200	West.	SK-100L
1	20	500/1500	G.E.	RP-11
1	20/25	400/1600	Reliance	T-23-T
1	20/25	300/1200	West.	SK-153
1	25	600/1200	G.E.	RP-13
1	25	500/1500	G.E.	RP-12
1	23/29	300/1200	G.E.	RP-13
1	30	400/1200	West.	SK-163
1	30/40**	400/1600	G.E.	CD-1236
1	35	500/1500	West.	SK-143
1	40/50	400/1200	Reliance	T-4611
1	75	500/1500	Cr Wh	CCM
1	75	375/750	Cr Wh	CMC-125‡
3	100	225/900	G.E.	MPC-A
5	100	400/1200	ALCh.	
1	100	320/960	West.	SK-200
1	125	450/1000	West.	SK-190
1	175	230/500	West.	SK-220
2	375	350/500	G.E.	MPC

**New.

SQUIRREL CAGE MOTORS—3 Ph., 60 Cy.
Totally Enclosed Fan Cooled, Ball Bearing

Qn.	HP	RPM	Volts	Make	Type
1	5	3480	220	G.E.	K-225
2	5	1750	440	L.A.	JA-254
10	5	1730	440	G.E.	K-254
2	5	1165	440	L.A.	JA-284
5	7.5	1740	440	G.E.	K-284
1	10	3480	440	West.	CS-324
1	10	1140	440	Wagner	CP2-326
1	10**	860	220	West.	CS-365-S *P
1	15	1745	440	West.	CS-326
1	15	1175	440	L.A.	JA-365
1	20	1790	220	G.E.	K-364
2	25	1760	220	G.E.	K-365
1	25	1200	550	G.E.	K-405
1	25	1170	220	L.A.	JX-405
1	25	705	440	West.	CS-W504
1	40	3565	440	G.E.	KP-4058

Splashproof, Ball Bearing

Qn.	HP	RPM	Volts	Make	Type
23	⅝	1750	440	L.A.	FS-254
1	5	1735	220	G.E.	K-254
1	5	1160	440	L.A.	FX-284
1	10	3480	440	G.E.	K-284
1	15	1175	440	L.A.	JA-365
4	15	1150	440	L.A.	FX-365
2	15	1175	220	G.E.	K-445
3	50	1760	440	L.A.	FX-445A
5	50	1160	220	G.E.	K-504
1	125	1770	440	L.A.	FX-1078Y
1	150	1775	440	L.A.	FX-1168
3	150	880	440	L.A.	FX-1368
1	150	700	440	G.E.	KF-6355
1	200	885	440	L.A.	FS-1378

Open Type Motors

Qn.	HP	Speed	Volts	Make	Type
1	15	3485	220	Reliance	AA-B3247
5	15**	1735	440	Century	SC320
1	15	1200	220	G.E.	KT-502
1	15	900	220	G.E.	KT-512
1	20**	3475	220	West.	CS-326
5	20**	1750	440	Wagner	RPI-364
1	20	1750	220	West.	CS-W364
1	20	1200	220	G.E.	KF-512
2	20	1160	440	West.	CS-464C
2	20	900	220	G.E.	FTR-522
1	25	1800	220	G.E.	KT-312
5	25**	1740	440	Century	SC-364
1	25	1160	440	West.	CS-667C
1	25	900	220	Howell	HCRB-358***
2	25**	875	440	Master	PB-405
2	25	575	440	G.E.	KT-542
3	30	3550	550	G.E.	K-3648
1	30	1160	440	West.	CS-644
1	30	870	220	West.	CS-646
1	40**	3545	220	G.E.	KF-4048
2	40	1750	440	West.	CS-583C
2	40	900	2300	G.E.	FTR-536
4	50**	1750	440	Wagner	RP5-405
1	50	850	220	West.	CCL
1	60**	1750	440	Ideal	AH-444
2	60	900	440	G.E.	KT-346
1	75	1160	440	West.	CS-662C
1	75	870	220	West.	CS-766A
2	75	885	2300	G.E.	KT-352
1	100	690	220	West.	C
1	100	580	2200	G.E.	IK-15A
2	100	600	2200	West.	CS-930
1	100	495	2200	ALCh.	AN
2	125	435	440	ALCh.	AR
2	125	400	2300	G.E.	I-17-FR
1	200	580	550‡‡	G.E.	KT-5668
2	300	587	2200	West.	CS-39A
1	400	1165	2200	G.E.	IK-E15B
1	500	1200	440	G.E.	KTP-567
1	700	1800	2300/4000	West.	CS-4-39D-12

220 volt motors can be reconnected for 440 volts.
**New. ***2 Phase. ‡‡Reconnectable for 440 volts.

G. E. DYNAMOMETERS

Cradle Type, with Control and Dial Scale
(Write for Complete Specifications)

Qn.	HP	DC Volts	RPM	Type
1	50/75	250	1650/4000	TLC-20
2	100	250	1050/3600	TLC-50
1	200	250	1200	C

MOTOR GENERATOR SETS

125 and 250 Volts D. C.
(Write for complete Specifications)

KW	Make	RPM	DC Volts	AC Volts
2	Cont.	1750	125	220/440
7.5**	West.	1455	125	380/220‡
10	West.	1750	125	220/440
10	West.	1450	125	220/440†
10	West.	1150	250	220/440
15**	G.E.	1800	125	220/440
15	G.E.	1755	250	220/440
15	West.	1450	125	220/440‡
16	West.	1750	125	2200/440
20	West.	1750	250	220/440
25	G.E.	1800	250	220/440
25	G.E.	1200	125	220/440
30	G.E.	1800	250	220/440
30	ALCh.	1750	125	220/440
50	West.	1750	250	220/440
50	G.E.	720	125	220/440†
75	G.E.*	1200	125	220/440
75	G.E.	1200	250	2300/440
100	Columbia*	1200	250	2300/440
150	West.*	1200	250	2300/440

Note: 3KW, 5KW & 7.5KW, 250 V Sets Available
**New. *Synch. Motor Driven. ‡50 Cy. 125 Cy.

Above Items Represent a Partial Listing Only. Your Inquiries Will Receive Our Prompt Attention. All Equipment is Located in Our Cleveland Warehouse. We Have Controls for Most Items Listed

ELECTRIC GENERATOR & MOTOR CO.
4521 HAMILTON AVE. CLEVELAND 14, OHIO

Reliably Rebuilt Electrical Equipment

Rebuilt — 1 YEAR GUARANTEE

PARTIAL LISTINGS ONLY

MOTORS
Squirrel Cage 3 Phase

HP	Make	Type	Speed
450	GE(vert)	KF-6338	1180
200	Wagner	RP2	1750
200	GE	KF-6335	880
150	West(2)	CS	1750
150	West	CS	580
125	AlCh(2)	AR	435
100	Wagner New	XP	1150
100	GE	K-544	1175
100	West	CS	870
100	GE	IK	720
75	West	CS	1750
75	GE(2)	K-506	1175
75	GE	IK	900
75	GE(3)	KT-352	865
75	West	CS	720
75	GE	K-356	690
75	GE	KT-558	580
60	F-M	Tot.Enc.	1800
60	West(2)	CS-607	880
60	Rel(2)	AA	875
60	GE	KT-346	865
50	GE	FTR-523	3600
50	Elliott	196	3450
50	West	CS	1740
50	LA(3)	XP	1150
50	West	XP	1150
50	GE	KF-445	1170
50	West	CS-642C	1160
50	West(3)	CS	870
50	GE(2)	IK	870
50	GE	FTR-542	870
50	West	CS	690

MOTORS
Slip Ring 3 Phase

HP	Make	Type	Speed
600	CrWh	131AQ	507
500	GE	IM	1200
500	GE(2)	IM	460
400	West	CW	514
225	Wagner	25cy	710
200	GE	MTP-557	1800
200	GE(2)	IM	1170
150	Wagner	31VRN	900
150	GE	MT-564Y	580
100	GE	MT-553	1165
100	AlCh		690
75	West.	CW	1150
75	GE		690
50	West.	HF	880
50	AlCh		690
50	GE	MT-536	1150
50	West	CW	1150
50	GE	MT-336	1150
50	LA	OCH	870
50	F-M	BV	690
50	AlCh	ARY	575
50	GE	IM	490

MOTORS
Synchronous

HP	Make	Type	Speed
600	AlCh(2)		120
475	West		720
400	GE(2)	TS-9288	600
300	GE	ATI	900
260	GE	TS	900
250	Ideal		360
200	GE(2)	25cy	500
200	Ideal	SMW	257
180	GE	ATI	900
160	GE	TS	1200
145	GE	ATI	720
135	West	G	1200
135	Ideal		1200
100	GE	TS	1200
100	ElMach		200
55	ElMach	BRKT	1200

MOTORS — 230V. D.C.

HP	Make	Speed
400	AC	415
135	CW	233/900
125	GE	1750
100	GE	1750
100	AlCh	1150
90/45	GE	950/475
75	Sprague	1000/1500
75	West(2)	475
75	CrWh	480/670
75	CrWh	375/950
75	West(3)	250/1000
60	West(3)	680
50	GE	1750
50	Diehl	850/1050
45/90	GE	475/1950
50	West(3)	565
50	GE	250/1000
50	West	250/1000
40	West	1750
40	Century	1740
40	GE	1700
40	GE	1100
40	GE	750
40	GE(2)	400/1500
40	CrWh	700
40	Rel	400/1200
35	West	1150
35	GE	440/800
30	GE(8	2200
30	West	975
30	Cont	850
30	GE	775
30	West	500/1500
30	West(2)	575
25	GE	1750
25	West	1750
25	GE	1750
25	ED	1500
25	Rel	1150
25	West	500/1500
25	West(2)	600
25	GE	300/1200

MOTORS—550V. D.C.

HP	Make	Speed
765	GE(6)	1045/1350

GENERATORS
250V. D.C. M.D.

KW	Make	Speed
1000	GE	900
500	West	1100
300	Elliott	1200
300	GE	1200
300	AlCh	1200
200	GE	1200
150	West	900
100	Delco	1200
75	GE	1200
50	GE	1200
40	Rel(4)	1750
42	AHC(2)	1200
30	GE	1200
25	GE	1200

GENERATORS
125V. D.C. M.D.

KW	Make	Speed
250	GE	720
150	CrWh	1200
150	West	1150
100	West(2)	900
100	GE	1200
100	ElMach	1200
75	CrWh	1200
75	Hertner	1150
50	West	1150
50	CrWh	1150
50	Sturt	2900
35	Ideal	1200
30	GE	1150
30	LA	1450
25	ElMach(2)	1150

A.C. GENERATORS
Driven by D.C. Motors

KVA	Make	DC Input	AC Output
288	West	115	450
75	GE	230	240
50	Star	115	120
35	GE	230	220
31	Ideal	115	440
31	ElMach	230	440
18	GE	230	120/240
10	Burke	115	120
7½	Hertner	115	440
5	ElSpec	115	110
1¼	AlCh	230	110

GENERATORS—A.C.

KW	Make	Type	Speed
216	West	G	900
180	GE	ATB	900
100	GE	ATB	360
75	GE(2)	ATB	1200
50	F-M	GG	1200
15	GE	ASI	1200

TRANSFORMERS

4—333 KVA Moloney, 2300/4600 V. Primary, 230/460V. secondary.
1—300 KVA, Al. Ch. 3 ph, 41600 V. primary, 230V. secondary.
1—300 KVA, Pittsburgh, 3 ph, 41600 V. primary, 230V. second.
8—100 KVA West. 3 ph. 440-220 Dry.
2—50 KVA GE—H—KF, 2400/4160Y—120/240V. secondary.
4—25 KVA West 440V. primary, 110/220V. secondary.
3—15 KVA West 440V. primary, 110/220V. secondary.
60—Additional Oil and Insulated Dry-type Transformers in stock not listed, down to 1 KVA.

L. J. LAND, INC.

EST. 1910 — 41st YEAR

156 GRAND ST. CAnal 6-6976 NEW YORK 13, N. Y.

THOUSANDS OF ITEMS IN STOCK
New & Reconditioned

PUMPS CENTRIFUGAL PLUNGER ROTARY

Air Compressors—Steam Pumps
Vacuum Pumps—Turbo Blowers
Electric Motors & Generators
Gasoline & Diesel Engines
Gear Reducers & Transm. Supplies
Condensation Return Units
Steam Turbines & Engines
Hydraulic Pumps & Presser
Pressure & Exhaust Blowers
Paint Spraying Equipment
Portable Agitators & Mixing Tanks
Above In All Sizes, Types, Makes

SUPERIOR EQUIPMENT CO.
136 GRAND ST., N.Y.C. 13. CA-6-6983

FOR SALE

MODERN 1000 KW Turbo-Generator

In Excellent Condition

Non-Condensing, Steel case 80# back pressure .8 P.F., 3 phase, 60 cycle, 4150/2300 volts, alternating current, complete with accessories, switchboard, oil circuit breaker, and direct connected exciter. Only operated alternately for six years. Ideal for Chemical, Rubber, Petroleum, Textile, Pulp and Paper, and Sugar Refining Industries.

NEWMAN & COMPANY, INC.
739 Drexel Building Philadelphia, Pa.

CENTRIFUGAL PUMPS—M.D.

Bought New 1948 Never Installed

4—Union, Base Mounted, Motor Driven, Hor., Split Case, Single Stage, Side Suc. Centrifugal Pumps, with Louis Allis 3 ph., 60 cy., 220/440 vo., 1760 RPM Motors, all 110 lbs. or 254 ft. head.

1—900 G.P.M.—100 H.P. Motor, 6" S., 5" D.
1—900 G.P.M.— 75 H.P. Motor, 5" S., 4" D.
1—400 G.P.M.— 50 H.P. Motor, 4" S., 3" D.
1—200 G.P.M.— 30 H.P. Motor, 3" S., 2" D.

Also

1—60" Dia. x 22' Pressure Tank, ASME Const., 150 lbs. W.P.
1—Open Discharge Tank 6'8" Wide, 7'0" High x 22'0" Long, ¾" Material, Welded Const., with Angle Iron Trim.

DELTA EQUIPMENT CO.
148 N. 3d St. Phila. 6, Pa.

COMPLETE POWER PLANTS

STEAM — ELECTRIC — HYDRO — DIESEL

"Export Orders Carefully Executed"

BOILER UNITS

1—140,000# New Steam Generator 900#, also Super
2—80,000# Boilers, 625#, 825° F.tt., Economizer and Air-heater
2—60,000# B&W 450# superheat
3—30,000# B&W 450# superheat
1—1000 HP Vogt 300# with Super
3— 750 HP Stirling Type Boilers 200#
2— 600 HP B&W Sectional header 200# Boilers
1— 400 HP B&W Co. Sectional—Super 200 to 350#
3— 500 HP B&W Sectional Header 230# Boilers
3— 300 HP Straight Tube 200# Boilers
Also smaller Boilers & Fire Tube Boilers

TURBO UNITS

1—10,000 KW. Extraction type, cond. 600#
1—10,000 KW Turbo-Generator—Cond.
1— 7,500 K W Turbo-Generator—Cond. 600#
1— 7,500 KW Turbo-Generator, Cond.
1— 5,000 KW Turbo-Generator—Cond.
2— 3,000 KW & 2—2500 KW Cond.
3— 2,000 KW same as above
2— 1,500 KW same as above } Also 400# & 600# turbos
2— 1,250 KW same as above
2— 1,000 KW same as above
1—500 KW same—Also 750 KW & 300 KW Units
Non-Cond.:—300—500—750—1000—1500—2000

Complete Steam Plants with 2—1250 KW; 2—2500 KW; 2—3000 KW & 7500 KW
Frequency Changers—Transformers! Send us your requirements—We may have it.
Send us your INQUIRIES *for* ALL POWER MACHINERY

CHARLES B. REARICK 30 CHURCH ST. NEW YORK 7, N. Y.

1—250 KW GE vertical unit 3-60-600V 327 RPM with Smith turbine and Lambard 5000 lb. governor. Exciter on top for 21' head.
1—250 KW 6-30-2400V exciter on top 5000 lb Woodward governor Leffel Z wheel for 16-29' head.
1—225 KW 3-60-2300V complete with Smith turbine for 18-20' head.
1—144 KW unit 3-60-600V 120 RPM Smith turbine for 9-13' head.
1—80 KW 3-60-2300V 300 RPM with exciter on top Leffel B turbine for 12' head or Smith turbine for 22' head.
1—1500 KW vertical unit 3-60-2300V for 50' head.
2—600 KW horizontal units for 50' head.
2—600 KW horizontal units for 50' head.
2—240 KW horizontal units for 100' head.
Many others available at low prices. We are headquarters for good used hydro-electric units.

WM. C. MOULTON ASSOCIATES
MONSON, MASS.

POWER EQUIPMENT—READY TO SHIP

A.C. MOTORS—3 PH. 60 CY.

No.	HP.	Make	Type	Speed	Volts
1 NEW	200	West.	SYN	1200	230/460
1	250	Burke	SYN	720	2200
1 vert.	250	G.E.		1175	2200
1	200	G.E.	I	900	2200
1	200	G.E.	SYN	1800	2200/550
1	175	West.	MH	1200	220/440
1	150	West.	SYN	257	220/440
1	150	West.	SYN	600	220/440
1 NEW	150	El. Mashy.		720	4160/2300
1	150	West.	SYN	900	2300
1	150	G.E.	I-K	1200	2200/220/440
1	150	West.	MH	1200	220/440
3	150	Louis Allis	FX	1750	220/440
4 NEW	125	West.	SYN	1200	220/440
1	125	G.E.	I-K	900	220/440
1 NEW	125	G.E.	TEFC	890	2300/440/220
1 NEW	125	Elec. Mach.		580	2300/440
1	125	Elec. Mach.	SYN	144	220/440
1	125	West.	TEFC	3600	220/440
1	112	West.	SYN	1200	220/440
1	100	Reliance	IT	695	220/440
1	100	G.E.	I	720	220/440
1	100	Al. Chal.		720	220/440
1	100	G.E.	I-K	900	220/440
1	100	G.E.	I-K	900	2300
1	100	West.	SYN	900	220/440
1	100	Cr. Wh.	SC	1160	2300/220/440
1	100	Louis Allis	OOS	1750	220/440
1 NEW	75	Al. Chal.	AR	855	220/440
1	75	Al. Chal.		580	220/440
1	75	West.	CS-877C	660	220/440
1	75	G.E.	I-K	600	220/440
1	75	G.E.	I-K	720	2200
1	75	G.E.	I	720	220/440
1	75	Louis Allis	OOS	1200	220/440
1	75	Burke		1200	220/440
1	75	Louis Allis	FAA-365T	1150	220/440
2	75	West.	CS (TEFC)	1750	220/440
1	60	Al. Chal.		515	220/440
1	60	G.E.	I-K	600	220/440
1	60	Cr. Wh.	SC	720	220/440
5 NEW	60	West. (EXPLOSION	CS-867 PROOF — TEFC)	900	220/440
1	60	Elec. Dyn.	Grip pr.	3600	4000/2300
2	50	G.E.	KT-546	730	220/440
2 NEW	50	Reliance (TEFC)	B-504-B	1750	2200
2 NEW	50	G.E. (TEFC)	K-594	1750	2200
1 NEW	30	West.	CS-445 Ml-3076	900	220/440

VARIABLE SPEED MOTORS—230 V. D.C.

No.	HP.	Make	Type	RPM
1	100	Westg.	SK-190	500/1000
1	100	G.E.	CD-185	400/1200
1 NEW	60	Westg.	CD	850/1700
1	50	Westg.	SK-170	350/1050

SPECIAL BARGAINS
Diesel Engine Generator Sets

10—100 kw., 120/240 v. D.C. Delco Generators dir. con. to 150 HP Model GBD-8, 5½x7, 8 cyl. Superior DIESEL Engines, elec. chart with engine panels

4—100 KW same as above with 230 or 440 v. NEW A.C. Generators

1—65 kva. 120/208 v. 3 ph. 60 cy. 1800 rpm., driven by Caterpillar DIESEL mt'd on trailer

1—60 kva Fairbanks Morse 220/440 v. 3 ph. 60 cy. 300 rpm DIESEL

1—75 KW 220/440 v. 3 ph. 60 cy. International GASOLINE

2—75 kva. 220/440 v. 3 ph. 60 cy. Delco Cummins DIESEL

1—62 kva Fairbanks Morse 220/440 v. 3 ph. 60 cy. 1200 rpm DIESEL

2—37½ kva., 220/440 v. 3 ph. 60 cy. Buda DIESEL

10—NEW 37½ kva., 220/440 v. 3 ph. 60 cy. LeRoi Gasoline

1—31.3 kva. 120/208 v. 3 ph. 60 cy. G.E. Gen. driven by LeRoi GASOLINE

11—NEW 25 kva. 120/220 v. 1 ph. 60 cy. Le Roi GASOLINE

3—25 KW BRAND NEW Onan 220/440 v. 3 ph. 60 cy. 1800 rpm GASOLINE

1—12½ kva. 120/240 v. 1 ph. 60 cy. 1200 rpm., dir. con. Hercules GASOLINE

2—12 kva. 120/240 v. 1 ph. 60 cy. Le Roi GASOLINE

2—7½ kw. 120/208 3 ph. 60 cy. Buda GASOLINE

SLIP RING MOTORS—3 ph. 60 cy.

No.	HP.	Make	RPM	Volts
1	500	Westg.	585	2300
1	400	G.E.	450	2300
1	250	Cr. Wh.	900	440/220
1	100	Triumph	580	550/440/220
1	75	G.E.	1200	220/440
1	60	G.E.	570	220/440
1	60	Westg.	900	220/440
1	60	Burke	1200	220/440
1	50	G.E.	570	220/440
1	50	Allis Chal.	690	220/440
3	50	Westg.	870	2200
1	50	G.E.	900	220/440
1	50/32	G.E.	800/640	220/440
1	30	Elec. Dy	1165	220/440

A. C. GENERATORS—3 ph. 60 cy.

No.	Kva	Make	Rpm	Volts
6 NEW	100	West	1200	220/440
10 NEW	37½	West	900	220/440
3	25	Onan	1800	220/440
11 NEW	25	West (1 ph.)	900	220/440

MOTOR GENERATOR SETS—250 V.D.C.
Motors 220/440 volt or 2200 volt 3 phase, 60 cycle

No.	KW	Make	RPM
3	250	Westinghouse	1200
1	200	Westinghouse	720
2	200	Westinghouse	1200
1	100	Westinghouse	700
1	100	General Electric	900
1	100	General Electric	600
1	100	General Electric	1800
1	100	Reliance	860
1	100	Delco	1200
1	75	Westinghouse	720
1	75	Westinghouse	1200
1	60	Westinghouse	1200
3	40	Westinghouse	900
2	30	Westinghouse	720

125 V. DC M.G. Sets

1—100 kw. G.E. 125 v. 900 rpm. 220/440 v. 3 ph. 60 cy. AC Syn.

1—75 kw. West. 125 v. 1200 rpm. 220/440 v. 3 ph. 60 cy. Syn.

TRANSFORMERS — 1 ph. 60 cy.

No.	Kva	Make	Pri.	Sec.
1	500	Standard	2200	575/460/345 230/115
3	500	G.E.	2300	230/460
6	333	Mahoney	2300	230/460
3	200	G.E.	2300/4000	230/460
2	150	West.	2400/4160	240/480
3	150	Pgh.	2300	230/460
1	100	Peerless	2300	230/460

NEW DIESEL ENGINES

4—HERCULES, 6 cyl. with power takeoff, max. 125 hp. @ 2000 rpm min. 60 HP. @ 1200 rpm.

NEW GASOLINE ENGINES

3—50 HP. 6 cyl. Chrysler Industrial Engines, power takeoff, outboard bearings for belt drive. Bargains.

GASOLINE FORK LIFT TRUCK

1—Clak Truelift 48" lift.

BRAND NEW TURBO SET

Westinghouse Steam Turbine consisting of 200 kw., 220/440 v., 3 ph. 60 cy. 1200 rpm., 80% P.F. A.C. Generator—40 kw., 120 v. 1200 rpm., D.C. Exciter and Westg. Reluction Gear.—Non-cond.

SPECIAL BARGAIN AIR COMPRESSOR

6—240 CFM Westinghouse type 3 VS-23 3 cyl. vert., 180 lbs. pres. dir. con., to 80 HP., 220/440 or 2200 v. 3 ph. 60 cy. West Silo Ring Motors, auto. control. Can furnish D.C. Motors or Oil or Gasoline Engines if desired.

WRITE, WIRE OR PHONE YOUR ELECTRIC NEEDS—SEND FOR STOCK LIST. LIST YOUR IDLE EQUIPMENT WITH US.

Duquesne Electric & Mfg. Co. Pittsburgh 6, Pa.

BOILERS

10 to 1000 H.P.

NEW-USED RECONDITIONED

Steam, Gas and Electric Power Equipment

J. PARKER THOMPSON CO., INC.
507 FIFTH AVE., NEW YORK CITY
MURRAY HILL 7-6547-8-9

FOR SALE

Power plant equipment. Steam, Diesel, electrical, boilers, engines, turbines, generators, new or used.

PENN MACHINERY COMPANY
Jackson, Miss.

Holly Gravity Return System
Steam Boilers and Accessories

RUSSELL B. HOBSON and SONS
GREAT NOTCH NEW JERSEY

DIESEL GENERATOR PLANTS

COMPLETE WITH SWITCHBOARDS

1000 KW to 100 KW

STATIONARY and PORTABLE

AT GREATLY REDUCED PRICES

NEW UNIT GUARANTEE

HERCULES ELECTRIC MACHINERY and EQUIPMENT CO.

Tel. NEvada 6-2808
Cable Address HEMCOY

1412 So. Alameda Street
Compton, Calif.

SPECIAL TRANSFORMERS — YOUR SPECIFICATIONS

NEW TRANSFORMERS
OIL COOLED
AIR COOLED
PHASE CHANGERS

ARROW TRANSFORMER CO., INC.
1932 E. Westmoreland St., Philadelphia 34, Pa.
GArfield 5-0433

USED TRANSFORMERS
REWOUND
REBUILT
RECONDITIONED

FROM AVAILABLE STOCK

Rebuilt to N.I.S.A. Standards

MOTOR GENERATOR SETS

3 ph. 60 cycle

Qu.	KW	Make	Speed	D.C. Volts	A.C. Volts
1	1800	G.E.	600	125/250	4000
1	1500	G.E.	600	600	2300/4150
1	1500	G.E.	360	275	2200/4400
1	1250	G.E.	600	275	2300
1	1000	G.E.	720	250	2300/13200
1	1000	Whse	900	600	2300/4150
1	1000	Whse.	514	250	4150
1	600	G.E.(3U)	1200	120/240	2300
1	750	Whse	900	250	2300
1	500	G.E.	720	600	2300/4150
1	500	G.E.	720	125	2300/4000
2	400	G.E.	720	250	440/2300
1	400	G.E.	1200	120/240	440
1	350	G.E.	900	125	2300/4150
1	300	G.E.	1200	250	440
1	180	Cr. Wh.	1200	250	440
1	140(3U)	Cr. Wh.	690	125/250	2300
1	100	G.E.	1170	125	220
1	75	Cr. Wh.	1170	250	220/440
1	75	Cr. Wh.	1200	250	550

ROTARY CONVERTERS

60 Cycle

Qu.	KW	Make	Speed	D.C. Volts	A.C. Volts
1—	2000	G.E.	514	600	13200
1—	2000	G.E.	450	600	2300
1—	1000	Whse.	900	600	11000
1—	750	Whse.	900	600	13200

RECTIFIERS

1— 750	G.E.	BHW	575	2300
1—1000	A.C.	B-613	625	13500
1—1000*	A.B.B.	GRZ	625	6600/13200

*This unit with full automatic control used for both 25 and 60 cycle.

TURBO GENERATORS

Qu.	KW	Make	Desc.
1	4000	G.E.	Auto Extraction 250# ISP 15# Ext. 2400V. 3 ph. 60 cy.
1	1000	G.E.	Condensing 135/150# ISP 2300/4150 V 3 ph. 60 cy.
2	750	G.E.	Condensing 250/275# ISP 440V. 3 ph. 60 cy. (New 1944)
2	400	G.E.	Condensing. 275# ISP Geared to 1200 RPM. 120/240V. D.C. Generator.
1	300	Worth.	Non-condensing 125/150# ISP 5/20# B.P. 240/480V 3 ph. 60 cy. direct conn. exciter.
1	300	G.E.	Non-condensing 150/175# ISP 5/15# B.P. 450V. 3 ph. 60 cy.
1	300	Al. Ch.	Condensing 425# ISP Geared to 1200 RPM 120/240V D. C.
	200	Cr. Wh.	Condensing 250# ISP Geared to 1200 RPM—125V. D.C. Gen.
1	200	Whse.	Non-condensing 150# ISP 7# B.P. 240V. 3 ph. 60 cy.

TRANSFORMERS

60 Cycles

Qu.	KVA.	Make	Type	Ph.	Voltages
1	2500	Packard	AT	3	13800 x 2300
1	2500	Al. Ch.	OISC	3	13200 x 2300
3	1000	Pitts	OISC	1	13200 x 2300
3	1250	G.E.	H	1	6600 x 550
1	1050	G.E.	WCTH	3	11000 x 445
1	1000	Makosy	OISC	3	13200 x 480
1	600	Al. Ch.	OISC	3	4000/2300 x 218
3	333	Pitts	OISC	1	24480 x 2400
3	250	Al. Ch.	OISC	1	2300 x 120
3	200	Whse.	OISC	1	7200 x 240/480
3	167	G.E.	OISC	1	2400 x 240/480

D. C. MOTORS

HP	Make	Type	Volts	Speed
1—1750	Whse.		600	535/720
1—1500	Whse.		525	600
1—1200	Whse.		600	425
1—940	Whse.	QM-R.Brg.	220	140/170
1—400/1000	Whse.		450	600/720
1—450	G.E.	MPC	250	115/145
1—400	Al. Ch.	MILL	230	400/600
1—300/400	G.E.	DYNA	250	1325/2500
1—335	Whse.	MG	250	300/900
1—300/300	G.E.	MPC	230	360/920
1—275	Whse.	QM-400-6	230	425/850
1—250	G.E.	MPC	230	400/500
1—150	G.E.	MPC	230	250/450
1—150	G.E.		600	250/750
10—150	Cr. Wh.	83H	220	880

FREQUENCY CHANGERS

1—2000	G.E.	25/60 Cycle	2300/2300V
1—500	A.C.	25/60 cycle	11000/2300V

A. C. MOTORS

3 ph. 60 cycle

SYNCHRONOUS

HP	Make	Type	Volts	Speed
2—3500	G.E.	TS	2300	257
1—2100	G.E.	ATI	4600	514
2—2000	Whse.		2300	120
1—1470	Whse.		4600	900
1—1000	Whse.		2300	189½
2— 900	Al. Ch.	(New)	2300	150
1— 650	Whse.	G	2200	138
1— 600	Whse.	Syn.	440	360
1— 450	Whse.	Eng.	2200	128.5
1— 350	G.E.	TS	2300	150
1— 320	G.E.	ATI	2300	600
1— 300	G.E.	ATI	440	720
1— 300	Whse.		2300	720
1— 300	Al. Ch.		440	600
1— 225	G.E.	ATI 1-Brg.	440	300
1— 125	G.E.	ATI	440	450
1— 100	E.M.	Unused	440	600
1— 100	Whse.		550	600

SLIP RING

1—1000	Whse.	CW	2300	700
2— 700	Whse.	CW	2300	900
1— 600	G.E.	IP	550	585
1— 560	G.E.	IM-Mill	2200	450
1— 400	G.E.	MT 413	440/2300	705
2— 350	Whse.	CW	2200	900
1— 350	G.E.	MT-443T	2300/4000	258
1— 300	Al. Ch.	3 Brg.	2300	585
1— 300	G.E.	IM	440	710
9— 200	Al. Ch.	ANY	2300	720
1— 250	G.E.	MT-424Y	4000	327
1— 250	G.E.	MT-559S	2200	1750
1— 100	G.E.	MT-565Y	440/2200	425
2— 100	G.E.	IM-16	2300	435
2— 100	G.E.	IM	440	600
3— 100	Al. Ch.	AK	2200	1200

SQUIRREL CAGE

2— 450	Whse.	CB	2300/4150	334
1— 300	G.E.	IK	550	585
1— 300	G.E.	KT-557	440	1800
1— 200/112	G.E.	KF-559BS	440	1170/585
1— 125	Whse.	MS	440	435
1— 125	(New) G.E.	KF-TEFC	440	1190
1— 125	G.E.	KF-TEFC	440	3585
1— 100	Al. Ch.	AR	2200	1170
1— 100	G.E.	IK-Vert.	2300	450
2— 100	G.E.	KT-543	220/440	1750

SYNCHRONOUS CONDENSERS

Qu.	Kva.	Make	Type	Volts	Speed
1	5140	Whse.		4150	600
1	4800	G.E.	TSC	2400/4800	900
1	3000	Whse.		4000	720

RE NU BILT BELYEA MOTORS

BELYEA COMPANY, INC.

43 Howell St., Jersey City 6, N. J.

Phone: Journal Square 2-3334

N.Y. Line: REctor 2-7150

POWER PLANT EQUIPMENT

SPECIAL OFFERINGS

TURBO-GENERATORS

1—New 16,000 KW 13,800 V. 0.80# Cd.
2—New 4000 KW 4160 V. 0.80# Cd.
1—3500 KW 550 V. 200# Cd.
1—2500 KW 540 V. 250# Cd.
2—1000 KW 2300 V. 400# Cd.
2—1000 KW 2300 V. 200# Cd.
2—1000 KW 400 V. 180# Cd.
1— 750 KW 400 V. 150# NC.
1— 750 KW 240 V. 156# Cd.
1— 750 KW 550 V. 170# EX.
1— 465 HP Turbine 900#

BOILERS

2—50,000# 300#
1—30,000# 400#
1—623 HP—450#
2—500 HP—200#
1—437 HP—200#
2—250 HP—125#
2—220 HP—160#
1—72" HRT 150#

DEAERATING HEATERS

3—90,000# Pr. Hr.

ENGINE GENERATORS

1—500 KW 2300 V. Unit.
1—375 KW 2300 V. Unit.
1—168 KW 220 V. Unit.

DIESEL GENERATORS

2—800 KW—2300 V.
2—200 KW—480 V.

COMPRESSORS

33,330 CFM—Cent. 7#
4800 CFM—Gas 50#
1700 CFM—100#
500 CFM—Diesel (2)

Write or wire for additional data and prints.

A. LEE ELLIS CO., U. S. Machy. Bldg., 140 Federal St., Boston 10, Mass.

THE BUYERS MUST BE SATISFIED—ALWAYS

---

600 KW DIRECT CURRENT GENERAL MOTORS DIESEL SET, Westinghouse Generator 500 Volt, 720 RPM, Electric Start. Unused.

450 HP ENTERPRISE DIESEL ENGINE, Model DSG-6, 6 cyl., 4 cycle, 450 RPM, air start, solid injection Unused.

Other sizes in stock from 10 to 1000 KW.

ALJOHN DIESEL CO., INC.

904-10 Pacific St., Brooklyn 16, N. Y.

STerling 3-6515

FOR SALE

ELECTRIC BATTERY CHARGER

Excellent Condition

Mfgr.—Electric Products Co. MG Set—50 HP, 220/440 V, 3 PH, 60 C, 60 Amp, 750 RPM, Cont. Duty Generator, AC Amp 60. DC Volts 84, DC Amp 420, 30 KW Dist. Board 5 circuits each charging 42 cells Edison type alkali battery, all auto. control, auto. starter.

PRICE — $1,750.00

F.O.B. Cleveland, Ohio
Subject to prior sale

CIMCO

2432 West Third Cleveland, Ohio
PRospect 1-5555

---

two 100 KW 250 Volt DC Generators. Steam driven by Ball Engines—140# pressure.

one 200 KW 250 Volt DC Generator. Steam driven by Ball Engine—140# pressure. Units complete with DC switchboard and two balancer sets.

one 20 ton York Vertical Ammonia Compressor. Steam driven by Corliss Engine—140# pressure.

one 15 ton York Vertical Ammonia Compressor. V belt drive. 33 H.P.— DC motor. Complete with condenser, receiver, valves, gauges, etc.

PURITY BAKERIES

97 E. 12th Street St. Paul 1, Minn.

BOILERS

4— 200 HP B&W Sectional headers
1— 410 HP Heine Box header
2— 400 HP B&W Sectional header
2— 500 HP B&W Sectional header
2— 500 HP Springfield
1—1400 HP B&W Sectional header
3—10,000# Rod Flash heating boilers

Locomotive fire box from 45 to 110 HP

NATIONAL BOILER & EQUIPMENT CO.
1501 So. Senate Ave., Indianapolis 25, Ind.

CONSULT US FOR

Diesel Gasoline and Steam Generators,
Electrical and Industrial Equipment

POWERITE CORPORATION

140 Cedar St. New York 6, N. Y.
Dept. 105 BA. 7-8199

---

asme — BOILERS — nat'l. b'd.

2—404 H.P. Springfield sectional, oil
1—250 H.P. Stirling, Coxe stoker
2—500 H.P. Erie City, oil
2—600 H.P. Stirling type, Spreader stoker
3—72" } Suspended HRT, hand fired
3—84" }

H. P. BREARLEY

34-23—31st Street, Jackson Heights, N. Y.

FOR SALE

7 Panels—Modern G.E. Metal-clad 15 KV switch gear at approximately half price
1000 KW G.E. Turbo unit and condenser
Two 2000 GPM pumps with motors.
I-R Compressor 20,000 CF/HR at 100# pressure
Motor-driven Blower—1000 cfm at 4 lbs.
Room 4200, 310 South La Salle St., Chicago 4, Ill.

MOTOR GENERATORS

DIEHL 120V. D.C. to 120V. A.C., 60 cy., 1 Ph. 2.5 K.V.A. Complete with magnetic controller, 2 field rheostats and full set of spare parts including spare armatures for generator and motor.

New $185.00

ALLIS CHALMERS 115V. D.C. to 120V. 60 cy., 1 Ph. 1.25 K.V.A., P.F. .80 Centrifugal starter. Fully enclosed.

New $97.50

Same as above but for 230 V. D.C. input **$110.00**

O'KEEFE AND MERRITT, 115V. D.C. to 120V. A.C., 50 cycles, 2 K.V.A., Pf. .9.

New $165.00

ELECTROLUX Dynamotor 105/130 V. D.C. at 6 amps. to 26 or 13V. D.C. at 20 amps. or 40 amps. respectively. Fully filtered for radio use and complete with Square "D" lineswitch. Navy type CAJO 211444.

New $74.50

Send for our complete list.

ELECTRONICRAFT INC.
5 WAVERLY PLACE • TUCKAHOE 7, N. Y.
PHONE TUCKAHOE 3-0044

BIGGEST BARGAIN IN HISTORY

Opportunity to Buy—Complete or Partially

$1,000,000.00 Power Plant

Consisting of:

2—Nordberg Engines with Allis Chalmers Generators, 750 KW, 440 Volt, 60 Cycle, 3 Phase.

1—Erie City 1000 H. P. Water Tube Boiler, water walls, economizer, dust collector, forced and induced draft fans, stub stack, completely steel incased, pulverizers. Boiler new in 1945. Used 6 months.

4—Wickes Vertical Boilers—500 H. P.

4—Coal Pulverizers.

Coal hoppers-elevatirs, conveyors, water softeners.

Coal Crushers-water heaters, electric and steam driven pumps.

1—Gantry Coal Crane.

For information, phone or write:

WISCONSIN IRON & METAL COMPANY
MILWAUKEE 16, WISCONSIN
Phone: Hilltop 5-1500

YOU'RE SAFE!—WHEN YOU BUY.... REBUILT POWER EQUIPMENT

. . . . FROM CHICAGO ELECTRIC YOU GET GUARANTEED QUALITY AND SAVE 40 to 70% IN PRICE

HERE'S A PARTIAL LIST OF OUR HALF MILLION DOLLAR STOCK

SLIP-RING MOTORS
3 phase, 60 cycle—220 or 440 volt (*2200 volt or higher)

H.P.	Make	Type	Speed
2000	*G.E.	MT	257
2000	*G.E.	MT-36	240
1250	*G.E.	M	720
1200	*G.E.	MT-26	277
800	*Westg.	CW	327
650	Westg.	HF	300
500	Westg.	CW	360
500	Westg.	CW	450
400	G.E.	IE	1800
300	*G.E.	IE15A-4	1800
300	G.E.	IM-17	1200
250	Westg.	CW-32B	900
250	Westg.	CW	600
200	G.E.	IM	600
150	Al. Ch.	ANY	600
100	G.E. NEW	M6330Z	900
100	G.E. NEW	M6334	720
100	Westg.	CW-356C	600
100	G.E.	IM-15A	450
75	G.E.	IM-E-14	1800
75	Westg.	CI-756A	600

SQUIRREL CAGE MOTORS
3 phase, 60 cycle—220 or 440 volt (*2200 volt or higher)

H.P.	Make	Type	Speed
750	G.E.	KT	720
500	G.E.	KTP-567	1200
400	*Al. Ch.	ANW	900
300	G.E.	FT-550A	1800
250	Westg.	CS-956A	600
200	Reliance	AA-6585B	1200
200	*G.E.	IE-15-K	600
150	Westg.	CS-771	1800
150	G.E.	IE-13AK	1800
150	G.E.	IE-13B	1200
150	G.E.	1-15-8	900
150	Westg.	CS-950A	600
125	G.E. TEFC	K-6326S	1200
125	G.E.	KT-558	900
100	U.S.-Vert.	CFU-994-A	1200
100	Burke	BM-12.5	1200
100	G.E.	K-6353	720
75	*Al. Ch.	AR-223BS	1800
75	Westg.	CS-505-S	1800

SYN. A. C. MOTORS
3 phase, 60 cycle—220 or 440 volt (*2300 volt or higher)

H.P.	Make	Type	P.F.	Spd.
1000	*Westg.	SC-3D35S	.8	900
700	*G.E.	ATI	.8	720
450	El. Ma.		1.0	240
320	*Al. Ch.	Dr. Prf.	1.0	720
250	*Al. Ch.		1.0	720
200	*Al. Ch.		1.0	360
150	G.E.	ATI	.8	600
125	G.E.	T8-9548	1.0	1200
100	Cr. Wh.	103-8	.8	900
100	G.E.	ATB	.8	900

A. C. GENERATORS
3 phase, 60 cycle—220 or 440 volt (*2300 volt or higher)

1000	*Westg.	803D	.8	800
725	*G.E.	ATI	.8	720
350	*Al. Ch.		.8	720
156	G.E.	ATI	.8	600
125	El. Ma.	EM	.8	720
112	G.E.	7092548	.8	1200
110	*Cr. Wh.	103-5-8	.8	900
100	*G.E.	ATI-8	.8	900

BOILERS
507 HP Comb. Eng. water tube 400# | 404 HP Sprgfld. sec. head, 200# | 400 HP B.&W. beat tube, 200# | 360 HP B.&W. Sec. head 200#

MOTOR GENERATOR SETS

K.W.	Make	A.C.	D.C.
1000	G.E.	4600	275
500	G.E.	2300	230
500	G.E.	440	250
500	G.E.	4000	1200
500	G.E.	2300	235
450	G.E.	2300	120
200	Cr. Wh.	2300	120
200	G.E.	440	235
150	Al. Ch.	220	120
100	G.E.	440	230
75	Star	440	230
75	G.E.	440	230
60	Al. Ch.	2300	115
60	Fr. Morse	220	120
50	Westg.	220	130
40	Cr. Wh.	220	135
20	G.E.	440	250
20	G.E.	440	125
15	Ideal	220	135
10	Cr. Wh.	220	125
10	Ideal	220	125

LOW VOLTAGE—M. G. SETS

Amp.	Make	A.C.	D.C.
1500	Chandyn	440	60
1500	G.E.	2300	60
1000	Chandyn	440	40
333	Columbus	440	45

TURBINE SETS—A. C.

KVA	Make	Press.	Volt
1800	Gen. Elec.	400-C	2300
1250	Gen. Elec.	750-SC	2300
625	Al. Ch.	140-C	480
312	Moore-C.W.	125-C	480
25	DeLaval-C.W.	150-SC	240

D. C. MOTORS—230 V.

H.P.	Make	Type	Speed
250	G.E.	MPC-6A	750/975
150	G.E.	RC-39A	600
100	Al. Ch.	E-182	875/1150
100	West. Elec.	RC-34	2500
75	G.E.	RC	1200
60	Westg.	SK-133	1200
40	Both	FR-50	650
40	G.E.	RC-34A	750
40	Al. Ch.	R-131	850
35	Cr. Wh.	CM-351	700
25	Sprague	C	600
20	Westg.	SK-120	975
20	Sprague	C-60	300
20	Cr. Wh.	CCM-50H	450
25	Westg.	SK-100L	1700
25	Al. Ch.		700
25	Westg.	S-9	500
20	Westg.	SK-83	1800

D. C. VARI-SPEED—230 V.

500	G.E.	MPC	160/ 650
325	Westg.	QM	450/ 900
250	G.E.	MPC	750/ 900
125	Reliance	1050T	600/1800
100	Al. Ch.	E-182	525/1150
60	Westg.	SK-170	525/1000
60	Nat.		250/1000
35	Sprague	C-60	300/ 900
30	Westg.	SA-8	500/1500
30	Westg.	SA-12	600/1200
25	G.E.	CD-105	500/1500
20	Al. Ch.	E-145	500/1200
15	Reliance	145T	400/1600
15	G.E.	CD-150	400/1600

HOISTS
3 phase, 60 cycle, 220 or 440 volt

Cap.	Make	Lift	Design
6000	Shaw Box	27	Lo-head
6000	Shaw Box	17	Std.
4000	Yale	17	Lo-head

2 COMPLETE VARI-VOLT DRIVES
M.G. Set. 200 K.W., D.C. gen., Elec. type MPC. 230 volts. 800 amps. 1200 RPM. dir. conn. to 300 HP syn. motor, Gen. Elec. type TS. 3 ph. 60 cy. 440 volt, .8 PF. 1200 RPM. D.C. Motor, 230 HP, Gen. Elec., type MPC. 245 volts. 730/975 RPM. with complete starting and control panels.

1000 K.W. Gen. Elec., type MPC, shunt 275 volt, 3640 amp. direct connected to 1120 KVA Gen. Elec. type TS. 3 ph. 60 cy. 4600 volt. 141 amp. .8 PF. 514 RPM. on fab. sub-base 250 volt fields bus excited.

750 K.V.A. DRY TRANSFORMERS
6—750 KVA. Westinghouse air cooled Class B. wdg. 18,800 V. pri. to 416 V. sec. 3 ph. 60 cy. 4—2½% taps.

CHICAGO ELECTRIC

Carries a complete stock of "rebuilts" in:

- AC MOTORS
- DC MOTORS
- GENERATORS
- M. G. SETS
- TRANSFORMERS
- SWITCHBOARDS
- COMPRESSORS
- HOISTS
- PUMPS

PHONE
CAnal 6-2900
TODAY

First Source for 40 Years for Quality Electrical Equipment

CHICAGO Electric Co.

1320 W. CERMAK RD. • CHICAGO 8, ILL.

FREQUENCY CHANGERS

—250 KVA Fairbanks-Morse 360 cycle/sync. motor drive.

—100 KW Elec. Prod. Co., 180 cycle/sync. motor drive.

—25 KW Gen. Elec., 240 cycle/squirrel cage motor drive.

Generating equipment of every description available. Your inquiry will get prompt attention.

MOTORS, M-G SETS
GENERATORS
TRANSFORMERS
FREQ. CHANGERS
CONTROL EQUIPMENT

ALL SIZES, ALL TYPES, ON HAND, in our large and varied stock. QUICK DELIVERY.

EMPIRE

LOW VOLTAGE M.G. SETS

1—2000/1000 amp; 6/12 volts Hanson Van Winkle Munning—AC Motor driven

1—2500/1250 amp; 6/12 volts, Elec. Prod. Co. AC Motor driven

Many other low voltage sets available from stock. Write for complete list.

ELECTRIC COMPANY, INC.
87-93 Jay St. • Brooklyn 1, N. Y.
Telephone: MAin 4-5900

GENERATE YOUR OWN POWER WITH "UTILITIES APPROVED" EQUIPMENT

TURBINE-GENERATOR UNITS

3 phase, 60 cycle

6250 KVA G.E. condens., 3 stage, 2300/4000 volts, 200# pressure, 600° TT, 3600 RPM.

3125 KVA G.E. condens. 130 P.S.I. 550 volts.

3125 KVA G.E. condensing 175/200 P.S.I., 2300 volt, 500° TT, 3600 RPM complete.

1563 KVA G.E. non-condensing 250 P.S.I. 25# gauge back, 2400 volts, 3600 RPM.

1563 KVA G.E. condensing 250 P.S.I. 2300 volts, 3600 RPM complete.

937 KVA Allis non-condensing 125 P.S.I. 10# gauge back 480 volts.

925 KVA G.E. non-condensing 150 P.S.I. 15# gauge back, 480 volts, 3600 RPM.

625 KVA Allis-DeLaval non-condensing 100 to 125 P.S.I. 10 to 15# gauge back, 2300/480/240 volts.

625 KVA Westinghouse condensing 150/200# pressure, 2300 volt, 3600 RPM complete.

625 KVA G.E. non-condensing 150# pressure 15# back, 2300 volts, 3600 RPM complete.

375 KVA (4) G.E. condensing 400# pressure, 480/800/2300/4150 volts complete.

112 KVA G.E. non-condensing 125# pressure 10# gauge back 480 volts.

100 KVA Westg. non-condensing 125 to 150# pressure, 10# gauge back, 2400 volts.

Direct Current

400 KW (2) 240 volts direct current Crocker-Wheeler Worthington 440 lbs. condens.

150 KW (2) 3 wire, 250 volts, 225/250 P.S.I. Westinghouse-Worthington condensing.

75 KW Allis-Chalmers-Terry, 125 volts, 2400 RPM, 150# pressure non-condensing.

75 KW (2) Westinghouse - Moore 120 volt, 200# pressure, condensing.

60 KW (3) new Westinghouse 120 volt, 200# pressure, condensing.

SYNCHRONOUS MOTORS

3 Phase, 60 cycle

5000 KVA Westghse. 4000 volt. 720 RPM
900 HP Allis, 2200 volts, 150 RPM
75 HP G.E. 230 volts, 720 RPM
300 HP 80% P.F. G.E. 2300 volts, 720 RPM

MOTOR GENERATOR SETS

500 KW General Electric 600 volt DC, direct connected to 710 HP, 3 phase 60 cycle, 2300 volt, 720 RPM synchronous motor.

400 KW General Electric 275 volt DC, direct connected to 710 HP, 3 phase 60 cycle 2300 volts, 720 RPM synchronous motor.

300 KW Allis, 250 volts DC generator direct connected 430 HP Allis 3 phase 60 cycle, 440 volt, 1200 RPM synchronous motor.

150 KW G.E. 125 volt direct current generator direct connected 225 HP, 3 phase 60 cycle 220 volt, 1200 RPM synchronous motor.

62½ KVA G.E., 60 cycle, 2300 volt, alternator to 75 HP, 125 volt DC motor.

ENGINE-GENERATOR UNITS

Direct Current

400 KW G.E. 240 volts, 360 RPM generator connected Skinner Unaflow vertical engine 150#, 10# gauge back.

275 KW Westinghouse 250 volt, generator connected Ames vertical Unaflow engine.

250 KW (3) G.E. 3 wire 250 volts generators connected Skinner Unaflow Engines.

100 KW Burke 3-wire, 250 volt generator connected Skinner Unaflow engine.

ENGINE-GENERATOR UNITS

Alternating Current—3 phase, 60 cycle

750 KVA G.E. 2300 volts generator connected Skinner Vertical Unaflow non-condensing engine 150# P.S.I.

625 KVA Westinghouse 240 volts, generator connected Skinner Unaflow Engine.

375 KVA G.E. 2300/440 volts, generator connected 23"x24" Skinner Horizontal Unaflow Engine 125—150 P.S.I.

175 KVA Westg. 240 volt generator connected Skinner Horizontal Unaflow Engine.

MAY BARGAINS

1—8400 sq. ft. and 1—4400 sq. ft Worthington surface condensers.

4—900 KW, 250/375 volt, direct current generators connected 1200 HP, 8 cylinders 720 RPM Fairbanks Diesel Engines.

1—5425 GPM, 70 foot head Centrifugal pump connected 125 HP 60 cycle, 2200 volt, 1750 RPM G.E. motor.

2—1000 GPM, 1270 foot head, 4-stage, Morris pumps each direct connected to a 417 HP, 390# P.S.I. non-condensing G.E. turbine.

UMC UTILITIES MACHINERY CORP.

1965 EAST 6th STREET • CLEVELAND 14, OHIO • Long Distance 422

Quality SINCE 1906 — Wente Motors

WIDE SELECTION UNUSUAL VALUES

THEIR ELECTRICAL CONSTRUCTION HAS BEEN REBUILT . . . BY EXPERTS

SQUIRREL CAGE
3 ph.—40 cy.—220 or 440 V.
(Other voltage as noted)

Qu.	HP	Make	Type	Speed
1	50	G.E.	I (2200 V.)	900
2	50	Al. Ch.		900
1	60	G.E.	KT	1200
4	60	G.E.	KT (2200 V.)	1200
1	60	Reliance	AA	900
1	75	G.E.	KT	1250
1	100	G.E.	KT (2200 V.)	900
4	100	G.E.	K (TEFCBB)	1200
1	110	G.E.	KTP	1800
1	120	G.E.	PT	3600
2	125	Cr. Wh.	136Q	450
3	125	Al. Wh.	AB	450
2	150	Al. Ch.		1750
1	250	G.E.	I-17	900
1	350	G.E.	KP (Vert.)	3600

SLIP RING—SYNCHRONOUS
3 ph.—60 cy.—220 or 440 V.
(Other voltage as noted)

1	50	Al. Ch.		720
1	50	Ideal	AV	600
1	50	G.E.	I	700
1	60	Ideal	AVX	1200
1	75	West.	CW	400
1	75	G.E.	I	520
1	75	Fr. Morse	BV (2200 V.)	1800
1	100	G.E.	TRB (1.0 PF)	600
1	100	G.E.	I-16 (2200 V.)	450
1	100	West.	CW (S.P.)	1800
1	100	KW G.E.	ATB (.8 PF)	900

Qu.	HP	Make	Type	Speed
1	125	Fr. Morse	T (2400 V) (PF1.0)	900
1	150	West.	CW	450
1	200	West.	CW (3 Bear.)	600

D.C.—230 VOLT
(Other voltage as noted)

1	50	West.	SK	850
1	50	G.E.	CD 1341	500/2000
1	50	Reliance	F	2700
1	50	West.	SK (115 V.)	500
1	60	West.	SK (115 V.)	500/1500
1	75	Diehl	K11	700
2	75/100	Reliance	T7050	800/900
1	100	West.	SK	850
1	100	Cr. Wh.	GM	800
1	130	Cr. Wh.	GMC (550 V.)	1200
1	150	West.	SK	400/1200
1	150	West.	SK	850
1	180	Cr. Wh.	GMC	450
2	200	Reliance	T2350	300/900
2	200	G.E.	TLC-74	1350/4000

M-G SETS

1— 45 KW West. 60 V DC—440 V AC 1200 RPM	
4— 60 KW G.E. 60 V DC—440 V AC 1200 RPM	
2— 75 KW El. Prod. 230 V DC—440 V AC 1200	
1—100 KW West. 250 V DC—440 V AC 1200	
1—100 KW West. 250 V DC—440 V AC 900	
1—100 KW Reliance 250 V DC—230 V AC 1200	
1—100 KW Ridge 275 V DC—440 V AC 1200	
1—150 KW G.E. 275 V DC—440 V AC 900	
ALSO—4000 motors other than listed from 1 HP to 200 HP	

The Wente Electric Co., Hamilton — 203 NO. FOURTH ST. Phone 4-8128 — Ohio

---

OPPORTUNITIES!

in

New and used equipment recently released from service by a number of electric and gas utility companies

POWER PLANT EQUIPMENT
CONSTRUCTION EQUIPMENT
SUBSTATION EQUIPMENT
TRANSMISSION LINE MATERIALS

Send for new list . . . to

EBASCO SERVICES INCORPORATED
APPARATUS EXCHANGE
Two Rector St., New York 6, N. Y.

FOR SALE

1—200, 150, 100 HP self-contained Boilers
1—150, 125, 100, 75 HP A.C. Motors—Rebuilt
1—200 KW GE 600 RPM, 480 V. Generator—Complete
1—500 HP Hamilton Corliss Engine
1—60x200' & 46x85' Steel Buildings
4—500 HP WT Boilers—Stirlings & 2-Drum
1—Brick Press—Testing Machine—Autoclave, Etc.

H. & P., 6719 ETZEL, ST. LOUIS 14, MO.

300 KW (375KVA) DIESEL POWER PLANT

LIKE NEW—(less than 300 hours use)—Completely Equipped

SPECIFICATIONS

ENGINES

3—Worthington Diesel Engines, model BB-5, 5 cylinders, 8x10½ operating at 600 RPM, rated at 150 H.P. continuous; equipped with Viking safety shut down and alarm system and Woodward Governors.

GENERATORS

The Engines are directly connected to:

3—Westinghouse, 125 KVA, 100 KW, 460 volts, 157 amps., 3 phase, 60 cycle. Generators with top mounted belt driven Exciters. Exciters rated at 5 KW, 125 volts D. C.

COOLING SYSTEM

3—Worthington, Model 18 EC evaporative coolers with electric motor pumps and heat controlled regulators. Each cooler has all the necessary valves, pumps, electric motors, controls and heat control for a complete installation.

STARTING EQUIPMENT

The Engines are started by compressed air and we are to furnish two Air Compressors; one with a 5 H. P. Westinghouse motor and the other Compressor will be driven by a one cylinder Wisconsin air cooled gasoline engine.

3—Air Tanks 47" high and 18" in diameter, 400# standard will be furnished with safety valves set at 250 lbs.

SWITCHBOARD

Switchboard furnished will have a swinging panel containing:
1—Synchroscope frequency meter and two volt meters. (One for the bus and one for the machines.)

Each of the three Generator Panels will contain:

1—A.C. ammeter
1—D.C. ammeter
1—Westinghouse silverstat voltage regulator.
1—Field discharge switch
1—Totalizing hour meter
1—Westinghouse air circuit breaker, 3 pole, 200 amp., 600 volts

Distribution Panels will be furnished containing:

2—200 amp. Air Circuit Breakers
10—25 amp. Air Circuit Breakers
8—50 amp. Air Circuit Breakers
7—100 amp. Air Circuit Breakers

SILENCERS

3—Burgess exhaust silencers with cleanouts, exhaust pipe including flexible exhaust piping with flanges.

FUEL TANKS

2—Day Fuel Tanks with gauges and electric float switches.
1—Hand operated fuel transfer pump.

BARGAIN PRICE — to sell from original foundation

PHONE — WIRE — IMMEDIATELY!

L. J. LAND, INC.

CAnal 6-6976

156 GRAND STREET **NEW YORK 13, N. Y.**

MOTORS—M.G. SETS—TRANSFORMERS

SQUIRREL CAGE MOTORS 3-PHASE 60-CYCLE

Qu.	H.P.	Make	Type	Volts	RPM
1	400	G.E.	1-K	2300	514
1	400	G.E.	KT-412	2200	425
1	250	Whse.	CS	2200	1160
1	200	Al. Ch.	AK	220/440	580
1	150	C.W.	126Q	220/440	570
1	125	Whse.	CS-761C	220/440	1750
1	125	Whse.	CS-772S	2200	1170
2	125	C.W.		220/440	430
1	125	Al. Ch.	AR	220/440	425
1	100	G.E.	1K	220/440	1755
3	100	Whse.	CS-663C	220/440	1750
1	100	Al. Ch.	AR-226	2200	1160
1	100	G.E.	KT-556	2200	865
5	100	F.M.	HS	220/440	880
1	100	Al. Ch.		550	720
1	100	F.M.	H-241B	220/440	450
1	75	Whse.	CS	440	1730
1	75	Al. Ch.	AR	2200	1705
1	75	Burke	EM-10	550	720
3	50	Whse.	CS	220/440	690

SYNCHRONOUS MOTORS 3 PHASE—60 CYCLE

Qu.	HP	Make	P.F.	Volts	RPM
1	1440	Whse.	.8	2300	514
1	700	G.E.	.8	2300/440	720
1	400	Whse.	.8	440	600
1	268	Al. Ch.	1.0	2200	900
1	150	Whse.	1.0	2200	400
1	125	G.E.	.8	2200	900
3	100	Whse.	.8	440	1800
1	100	Whse.	1.0	2200	1200
1	100	Ideal	.8	440/220	900
2	100	G.E.	.8	440/220	600
1	60	G.E.	.8	440/220	1200
2	50	G.E.	.8	2200	600

SLIP RING MOTORS CONSTANT DUTY 3-PHASE 60-CYCLE

Qu.	HP	Make	Type	Volts	RPM
1**	2000	G.E.	MT	2300	240
1**	1500	Al. Ch.	ANY	2300	220
2**	1000	Al. Ch.	ANY	2300	235
1**	800	G.E.	MT-12	2200/6600	600
1***	700	G.E.	MT432	2200	400
1**	600	G.E.	MT-412	2200	726
1	500	G.E.	IM	2200/4400	580
1	500	Whse.	CW	2200	575
1	500	Whse.	CW	440	600
1***	500	G.E.	I.M.	440	450
1**	500	G.E.	MT412	2200	450
1	400	G.E.	IM	2300	875
1**	400	G.E.	IM	2300	500
1**	400	Al. Ch.	ANY	2200	505
2	400	G.E.	MT412	2200	450
1	300	G.E.	IM	2200	1200
1	300	Al. Ch.	ANY	2200	505
1	250	Whse.	CW	2200	580
2	200	Whse.	CW	440	600
1	200	Al. Ch.	ANY	2200	583
1	200	Whse.	CW	550	514
1	150	G.E.	IM	440	495
1	125	Whse.	CW	2200	870
1	125	Al. Ch.	ARY	220/440	900
1	75	G.E.	IM	220/440	695
1	50	G.E.	MT-536	2200	1150
1	40	Al. Ch.	ANY	2200/440	435

**—Mill type pedestal bearing design.
***—Pedestal 3 bearing

TRANSFORMERS—OIL COOLED

Qu.	K.V.A.	Make	Type	Phase	Voltage
2	4500	G.E.	HT	3	27000/13500/2300
2	1000	Pitts.	OISC	1	22000/11000/1100/2200
4	500	G.E.	H	1	13200/11880/220/440
2	333	G.E.	H	1	6900/11950Y/230/460
3	333	G.E.	H	1	2300/460/230
3	200	Pitts.	OISC	1	13800/14400/220/440
3	130	G.E.	H	1	4160/7200Y/120/240
3	100	Whse.	SS	1	12075/10925/460/230
6	100	G.E.	H	1	4160/7200Y/120/240
3	75	G.E.	KF	1	2400/4160Y/120/240
3	50	Al. Ch.	OISC	1	22900/230
2	50	Wag.	HE	1	13200/11880/575/287

MOTOR GENERATOR SETS

Qu.	KW	Make	RPM	Volts DC	Volts AC
2	1500	G.E.	600	600	4160/2400
1	1000	Whse.	514	600	4160/2400
1	1000	Whse.	514	600	2300
1	750	Whse.	514	275/300	2200
1	600	Al. Ch.	900	250	2300
1	300	G.E.	720	125/250	2300/440
2	150	C.W.	900	250	2300/410
1	100	C.W.	900	250	2300/410
1	85	C.W.	1200	250	440
1	75	Whse.	1200	125	440/220
1	75	Al. Ch.	900	250	2300
1	75	Whse.	1200	250	2300/440
1	75	Whse.	1200	250	220/410
1 (3U)	50	Whse.	1200	120/240	440/220
1	35	G.E.	1800	125	440/220
1	30	Reliance	1800	250	440/220
3	25	Whse.	1200	120/240	440/220
1	15	Al. Ch.	1200	250	440/220
1	9	G.E.	1800	250	440/220

1—Reliance variable voltage set (3) 20-KW, 250-VDC Gen. with (1) 5-KW exciter and (1) 75-HP motor 440/220.

DIRECT CURRENT MOTORS 230 VOLT

Qu.	HP	Make	Type	RPM
1***	2500	G.E.	MCP-14	240/480
4***	1500	Whse.	Rail.	600
1***	1250	Whse.	Mill	300/600
1	500	G.E.	MPC	140/330
1	400	Al. Ch.	MSH	400/1200
1	325	Whse.	QM	450/900
1	200	El. Dy.	23	400/1200
1	200	Whse.	SK	300/1200
1	150	G.E.	MPC	262/525
2	125/150	Rel.	2556T	300/900
2*	150	C.W.	83H	890
2	109	Rel.	1050T	400/1200
1*	50/75	Rel.	1093F	300/1200
1*	40/60	G.E.	CD-173A	400/1200
1	50	Whse.	SK	300/1200
1*	30/75	Whse.	SK-151L	400/1200
1	35	Whse.	SK-140	500/1500
1	25	Whse.	SK-111L	250/1000

***—600-VDC mill type. *—T.E.F.C.

T. B. MAC CABE COMPANY

4314 CLARISSA STREET PHILADELPHIA, PENNA.

BREW-WOLTMAN OFFERS

TURBINE UNITS

1—12500 KVA Al. Ch. Cond. 60 cy. 6900 V. 250-lb. 600 deg. Surface Condenser.
1— 5000 KVA G.E. Non-C. 60 cy. 13200 V. 600-lb.
1— 3125 KVA Worthington Non-C. 60 cy. 2300 V. 150-200 lbs., 40 lbs. BP.
1— 2500 KVA G. E. Extraction Cond. 60 cy. 480 V. 185-200 lbs. steel valve chest.
1— 1563 KVA G. E. Extraction Cond. 60 cy. 480 V. 200 lbs.
1— 1250 KVA Allis Cond. 60 cy. 2300 V. 150-200 lbs.
1— 125 KVA West. Non-C. 60 cy. 240/480 V. 150-lb., 5-lb. BP
1— 25 KW Allis Non-C. DC 125 V. Exciter Dual drive turbine & motor.

ROTARIES — 60 Cy.

1—2929/3705 KW Gen. Elec. 225/285 V.
1—2160/2700 KW Gen. Elec. 240/300 V.
1—1000 KW Westinghouse 600 V.

DIESEL ENGINE UNITS

3— 700 HP Gen. Motors 2300 V. 60 cy. gen.
3— 650 Amer. Loco. 440 V. 60 cy. gen.
1— 600 HP Fair. Morse 2400 V. 60 cy.
1— 400 HP DeLaVergne 2400 V. 60 cy.

STEAM ENGINE UNITS

1— 312 KVA Skinner Uniflow, 480 V.
1— 312 KVA Ames Uniflow, 240 V.
1— 250 KVA Ames Vertical Uniflow, 480 V.
2— 167 KVA Ames Vertical Uniflow, 240/480 V.

SPECIALS

3—700 HP General Motors Diesel 8 cyl. 4 cy. 360 RPM dir. con. To 485 KW .8 PF 3/60/2300 V. generators.
1—4500/6000 KVA G. E. 3/60 transformer H.V. 66000 Gr. Y, 8 minus taps to 54224 L.V. 33000, 2—5% plus taps. Automatic H.V. load ratio control.

SYNCHRONOUS MOTORS — 60 Cy.

1—600 HP G. E. 440 V. 360 RPM
2—350 HP G. E. 2300 V. 257 RPM
1—300 HP G. E. 2300 V. 600 RPM
1—300 HP West. 2300 V. 900 RPM

INDUCTION MOTORS — 60 Cy.

1—300 HP West. S/R 2200 V. 1770 RPM
1—250 HP G. E. S/R 2200 V. 1800 RPM
1—200 HP Cr. Wh. S/C 2300 V. 720 RPM. NEW.
1—200 HP G. E. S/R 2200 V. 435 RPM
1—150 HP Cr. Wh. S/C 440 V. 900 RPM. NEW.
1— 75 HP Al. Ch. S/C 440 V. 900 RPM
3— 75 HP Cr. Wh. S/C 220/440 V. 1200 RPM

MOTOR GENERATOR SETS

2—1500 KW West. 250 V. DC 60 cy.
2— 500 KW Cr. Wh. 250 V. DC 60 cy.
2— 300 KW G. E. 250 V. DC 60 cy.
1— 75 KW Star 240 V. DC 60 cy.
1— 75 KW West. 125 V. DC 60 cy.

MERCURY ARC RECTIFIERS

2—4500 KW Multi Anode 600 V. DC
2—3250 KW Ignitron 650 V. DC

FREQUENCY CHANGERS

1—2500 KVA G. E. 25/60 cy. 300 RPM
1—1250 KVA West. 25/60 cy. 300 RPM
2—1000 KVA G. E. 25/60 cy. 300 RPM
1— 500 KVA Al. Ch. 25/60 cy. 300 RPM

TRANSFORMERS — 60 Cy.

1—4500 KVA G. E. 66000—33000, 3 ph.
3—1000 KVA West. 66000—7200
1—5000 KVA West. 34500—13750, 3 ph.
3— 667 KVA G.E. 33000—2300/4600
1—5000 KVA G. E. 33000—2300/4000, 3 ph.
6— 50 KVA G. E. 33000—2300
6— 75 KVA Moloney 33000—2300/6900
3—3750 KVA West. 26400/13200—2400
4— 450 KVA Al. Ch. 25410/44000—13200/23000
1—7500 KVA G. E. 13200 Rectifier Type
3— 333 KVA G.E. 13200—2400/4160 Y
3— 750 KVA West. 13200—440
3— 200 KVA Moloney 11000—2300
3— 167 KVA G. E. 7200/12400—240/480
1—1500 KVA West. 4800—2300, 3 ph. Auto
3— 167 KVA G.E. 2400/4160 Y—480
3— 250 KVA Al. Ch. 2300—460

OIL CIRCUIT BREAKERS

1— 600 A. 73 KV G. E. FHKO-139 Outdoor
1— 400 A. 37 KV G. E. FHKO-136-CB Outdoor
1— 400 A. 37 KV Condit FO-40-B Outdoor
1—1200 A. 34.5 KV G. E. FKO-339-1000 Outdoor
4—2000 A. 23 KV G. E. FKO-339-1000 Outdoor
4— 600 A. 15 KV G. E. FHKO-138BB Outdoor

PARTIAL LIST—WE HAVE ALL CLASSES OF POWER EQUIPMENT

BREW, WOLTMAN & CO., INC.

50 Church Street — New York City 7 — WOrth 4-1470

TURBINE GENERATOR UNITS

Two—1800 KW General Electric Turbo-generator Units. 400# 725°F condensing Turbine direct connected to 3600 RPM 2300 Volt 3 Phase 60 cycle generator with condenser, air jet ejectors and surface air coolers.

These units have just been completely reconditioned and rewound by General Electric and are available for immediate delivery from Buffalo, N. Y. warehouse.

Price—$38,000 per unit or $75,000 for both units.

BROKERS PROTECTED

AUTOMATIC COMBUSTION EQUIPMENT COMPANY, INCORPORATED

P.O. BOX 1478 — **ROCHESTER 3, NEW YORK**

FOR SALE

COAL AND ASH HANDLING EQUIPMENT

at Baltimore, Maryland.

Partially installed in 1943. Never used. Consists of coal conveyors, coal elevator and attendant equipment of 25 tons capacity bituminous per hr. Also, Riley No. 5 duplex Atrita pulverizer with attendent equipment of 20,600 lbs. capacity per hr. Also, conveyors and attendant equipment for ash and fly ash removal of 14 tons dry ash capacity per hr. Bids desired on as is, where is basis. Address inquiries to **Mr. C. E. Paules, attention: Mr. A. B. Strickler, Standard Oil Development Company, Esso Engineering Department, P. O. Box 121, Linden, New Jersey. Telephone: Elizabeth 2-3900.**

MODERN AIR COMPRESSORS

6040 Ft. INGERSOLL RAND 60 LB. ELECTRIC.
3865 Ft. NEW CHICAGO PNEU. DCE, ELEC. 125 LB. WITH MOTOR TO SUIT.
3176 Ft. SULLIVAN WN4 ELECTRIC. 125 LB.
1578 Ft. CHGO. PNEU. DIESEL. 125 LB.
1302 Ft. INGERSOLL RAND PRE-2 ELECTRIC. 100 LB.
610 Ft. WORTHINGTON V BELT DRIVE. 125 LB. WITH OR WITHOUT MOTOR.

DARIEN, 60 E. 42nd St., New York 17, N.Y.

CONSULT
with us on
Boilers, Turbines, Engines Diesels, Generators, M.G. Sets, Transformers & Switchgear.

MERRILL and COMPANY
407 So. Dearborn St. • Chicago 5, Illinois

MOTORS • GENERATORS • TRANSFORMERS

MOTORS
3 PHASE—25 CYCLE—220/440 VOLTS

H.P.	Make	Type	Frame	RPM
150	Gen. Elect.	IK-17		365
150	Gen. Elect.	IK-16		480
150	Gen. Elect.	IM-16	Slip Ring	480
150	Allis Chalmers			1450
150	Gen. Elect.	KT	557	1455
200	Westinghouse	CS	2200 volt	1500
350	Westinghouse	CW	Slip Ring	500
500	Gen. Elect.	IK		485
600	Gen. Elect.	MT	Slip Ring	490
600	Westinghouse	CS		490

HIGH FREQUENCY M-G SET

250 KW G.E. single phase 460v., 960 cy., 3600 RPM. direct connected to 375 HP G.E. induction motor 3 ph., 60 cy., 460 v. Complete with motor starting equipment, generator and exciter panel.

350 KW GENERATORS

2—350 KW G.E. generators type MFC, 250 v. D.C. 720 RPM single bearing machines.

DIRECT CURRENT EQUIPMENT

125 or 250 v. motors and motor generator sets in all sizes.

6250 KVA TURBO-GENERATOR

1—6250 KVA Gen. Elect. Unit—Generator 3 Phase, 60 cycle 2300/4160 Volts 3600 RPM. Complete Installation For Immediate Delivery.

200 HP SYNCHRONOUS MOTOR

200 HP Gen. Elect. Synch. Motor—New 3/60/2300/225 RPM—1.0 PF Engine type with M-G set for excitation and 200 HP Gen. Elec. New Full Voltage Syn. Dead Front Control Panel.

700 KW M.G. SET

1—850 KW Gen. Elect. Type MFC 250 volt, 720 RPM Generators will direct connect to 1000 HP Synchronous Motor or will sell Generators separately.

200 KW M.G. SET

300 KW Westinghouse NEMA Frame Generator 250 Volt DC, 1200 RPM, direct connected to 300 HP Westinghouse Synchronous motor 3/60/208/1200 RPM. A.C.—D.C. Panels—Like New

Immediate Shipment

SLIP RING MOTORS
3 Phase—60 Cycle—220/440 Volts

H.P.	Make	Type-Frame	Speed	Remarks
2— 20	LA1	KH	900	
20	G.E.	MT-265	1200	
30	Ch. Wh.		1200	
3— 35	West.	CW	585	
35	G.E.	MT-243	690	
35	West.	MW	690	
40	West.	CW-745A	690	
6— 40	G.E.	MT-256	1200	
40	G.E.	MT-525	1800	
50	G.E.	MT-526	1200	
50	G.E.	MT-527	1800	
3— 50	West.	CW	1200	
60	G.E.	MT-523	1800	
60	West.	CW-685C	1800	
100	West.	CW	485	3 bearing
3—100	G.E.	1 form M	900	
2—100	G.E.	MT-247	1200	
125	G.E.	1 form M	1200	
3—250	G.E.	1 form M-16	900	
350	West.	CW	485	2200 volts
500	Al. Ch.	ANY-WR	514	2200 volts
600	G.E.	MT	450	25 cycle
This motor will rewind satisfactorily to 700	G.E.	MT	720	

HORIZONTAL & DUPLEX
Compressor & Vacuum
Pumps after Coolers, Filters

NEW TRANSFORMERS
Stock Shipment

3—25 KVA Niagara O.I.B.C. 2400/120/240, 1 Phase, 60 cycle, with taps.
6—25 KVA Niagara O.I.B.C. 2400/240/480, 1 Phase, 60 cycle, with taps.
3—37½ KVA Niagara O.I.B.C. 2400/120/240, 1 Phase, 60 cycle, with taps.
6—37½ KVA Niagara O.I.B.C. 2400/240/480, 1 Phase, 60 cycle, with taps.
3—50 KVA Niagara O.I.B.C. 2400/120/240, 1 Phase, 60 cycle, with taps.
6—50 KVA Niagara O.I.B.C. 2400/240/480, 1 Phase, 60 cycle, with taps.
4—75 KVA Niagara O.I.B.C. 2400/240/480, 1 Phase, 60 cycle, with taps.
9—100 KVA Niagara O.I.B.C. 2400/120/240, 1 Phase, 60 cycle, with taps.
7—100 KVA Niagara O.I.B.C. 2400/240/480, 1 Phase, 60 cycle, with taps.
6—150 KVA Niagara O.I.B.C. 2400/240/480, 1 Phase, 60 cycle, with taps.
1—167 KVA Niagara O.I.B.C. 2400/100/240, 1 Phase, 60 cycle, with taps.
7—250 KVA Niagara O.I.B.C. 2400/240/480, 1 Phase 60 cycle, with taps.
1—333 KVA Niagara O.I.B.C. 2400/240/480, 1 Phase, 60 cycle, with taps.

TRANSFORMERS

3—100 KVA Gen. Elect. Transformers, Type H Form KF—2400/4160 volts primary 120/240 volts secondary. Price $450.00 each. Electrically O.K. F.O.B. truck, Minnesota.
2—50 KVA Gen. Elec. Transformers, Type H Form K—1 Phase 60 Cycle 2300 Volts Primary 115/230 Serial No. 2154638.
3—500 KVA Westinghouse Transformers, Type SK—1 Phase 25 Cycle 2300 Volts Primary 115/230 Volt Secondary. Serial No. 1214689-90-91
2—100 KVA Kuhlman OIBC 60 cy., 1 phase, 11,000v. primary, 240/480v. secondary.
1— 50 KVA Kuhlman OIBC 60 cy., 1 phase, 11,000v. primary, 120/240v. secondary.

FREQUENCY CHANGERS

All Sizes in Stock. 60 cycle to 90 cycle, 180 cycle, 120 cycle, 180 cycle and any other high cycle.

ERIE ELECTRIC CO., INC. 124 CHURCH ST. BUFFALO, N. Y. CL. 4758

SACRIFICE FOR IMMEDIATE SALE

GOOD AS NEW—BUILT 1942

2—Kewanee Type C. No. 1789. HS 2143 Radiation 36,430 ft. Series 2X, Pressure 15# PSI. Gas fired with all controls, magnetic valves, gas valves, flame controls, gas flow meter, etc.

STOCKYARD IRON CO.
Box 4111 MEMPHIS, TENN.
Phone 9-6000

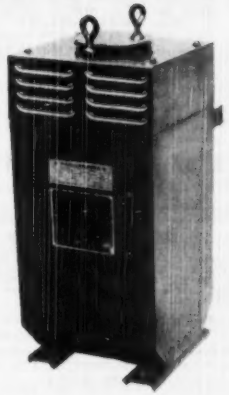
TWO STOKERS, COMPLETE

Detroit Overfeed Rotostoker—double feed. Capacity: 500 boiler H.P. Grate area: 45 sq. ft. Grate dimensions: 6 ft. x 7 ft. 6 in. Stokers complete with forced draft fans. Stoker parts: 4 feed units, 2 drive units, 2 blower fans, 2 wind tunnels, 2 set grates, 2 boiler fronts for mounting feed units.

PURITY BAKERIES
97 E. 12th St. St. Paul 1, Minn.

Special Offering!

2000 NEW air cooled TRANSFORMERS



• WILL OPERATE ON 220 AND 440 CIRCUITS

All transformers insulated with fiber glass; no fireproof vaults required. For lighting and power.

★ LOW PRICES ★

KVA	VOLTAGE RATING
¾ to 25	450 to 117
7½ to 25	225/450 to 117/234
PHASE CHANGERS	
15 to 50	220 or 440 to 220

MANUFACTURED BY ALLIS CHALMERS

• Crated for immediate delivery

AMERICAN ELECTRIC SERVICE & MAINTENANCE CO.
SPRINGFIELD, MASS.
MOTORS • GENERATORS • TRANSFORMERS • SALES • REPAIRS • RENTALS

Most all units still on foundation. Many may be seen operating

TURBO UNITS (Cond.)

1625 KVA Wghse. 2300 v., 150# (bleeder)
1250 KVA Elliott 2300 v., 200# (bleeder)
1250 KVA (2) Elliott 480 v., 150/200#
1250 KVA Wghse. 2300 v., 450#
1250 KVA GE 4150 v., 200#
937 KVA Elliott 2300 v., 175# (bleeder)
750 KVA GE 2300 v., 200#
625 KVA (2) GE 2300 v., 150/200#
625 KVA GE 2300 v.—Murray, 250#
375 KVA Wghse. 220/110 v., 100/125#
375 KVA Al. Chal. 480/240 v., 190#

TURBO UNITS (Non-Cond.)

1875 KVA GE 2300/480 v.
937 KVA Al. Chal. 480 v., 150#
750 KVA GE 550 v., 70# BP
625 KVA GE 2300 v., 150/200#
250 KVA GE 600 v., 150/200#
62½ KVA; 112 KVA; 125 KVA; 200 KVA and 250 KVA GE 480/220 v. units

DIESEL UNITS

250 KVA (2) Buckeye 2300/480 v.
250 KVA FM 2400/480/240 v.
109 KVA GE-Superior 240/480 v.
106 KVA GE—Murphy (portable) 220/440 v.
75 KVA (2) GM, 2400 volts
75 KVA (2) GM 480/240 v.

BOILERS

680 HP BW, sec. header, 200#
625 HP Vogt bent tube 450#
600 HP (2) B&W Sec. Header, 200#
540 HP Keeler 250#
509 HP (2) BW sec. header, 200#
509 HP Sterling, 450#
490 HP (2) Erie City 3 drum, 160#
480 HP Springfield, sec. hd. 250#
438 HP (2) BW 2 drum, bent tube 200#
400 HP Erie City, Heine type, 200#
250 HP (3) Titusville fire box 125#
250 HP (2) B&W 3 drum, 160#
250 HP (2) B&W 3 drum, 200#
162 HP (2) Keeler, portable, 250#

STEAM ENGINE SETS, A.C.

500 KVA GE-Skinner Unif.
450 KVA GE-Ames Unif. Cond.
400 KVA GE-Erie Ball 4 v.
312 KVA GE-Chuse 4 v.
312 KVA GE-Ames Unif.
312 KVA (2) CW-Skinner Unif.
250 KVA GE-Ames Unif. ver.
240 KVA GE—Nordberg Unif.
187 KVA Elec. Mchy.—Ames Unif. ver.
187 KVA GE-Chuse 4 v.
187 KVA Wghse.-Ames Unif. Ver.
62½ KVA GE-Ames Unif.

PUMPS — MOTOR DRIVEN
COMPRESSORS — MOTOR DRIVEN
TRANSFORMERS
MOTOR GENERATOR SETS

POWER PLANT EQUIPMENT CO., INC.

39 Cortlandt St.
New York, N. Y.

DIESEL POWER PLANTS

FOR IMMEDIATE DELIVERY

2—Complete Diesel Generator Power Plants, each consisting of 3—125 KVA Worthington BB5, 600 RPM, 3/60/230/460 V. with Evaporative Condensers, Air Compressor, Switchboard, and Silencers. New 1943. Test run only.

2—60 KW, G.M. 6-71RC, 3/60/127/220/440 complete. Used only 100 hrs.

1—100 KW, Hercules DNX6, 3/60/127/220/440. Unit completely enclosed.

(THIS IS ONLY A PARTIAL LISTING OF OUR INVENTORY. SEND US YOUR INQUIRIES.)

Heat and Power Co., Inc.

70 PINE STREET ▮ DIGBY 8-0373 ▮ NEW YORK 5, N. Y.

FOR SALE

BOILERS — TURBINES DIESEL SETS

STEPHENS A. DOUGLASS CO.
630 Ft. Washington Ave., N. Y. 33, N. Y.

USED ENGINES and BOILERS FOR SALE

100 H.P. Erie City and 323 H.P. Springfield Boilers, 450 H.P. Murray Corliss Engine, 75 H.P. Chuse Engine with 40 KW Generator, Feed Water and Centrifugal Pumps, also 300 H.P. Kerr Turbine with 200 KW Generator, Permutit H20 Softener.

SAXONY MILLS, St. Louis 2, Mo.

FOR SALE

2—Wm. Bros Boiler & Mfg. Co. HRT boilers. 72" diameter x 18' designed for 150# per sq. in. working pressure, 70—4" tubes, double suspension and full flush front, equipped with regular trimmings, arranged for stoker firing. Have Hays type CSE furnace controller with power unit and gauges.

2—Riley Jones side dump automatic underfeed stokers with Clarage type HV fan and GE 7½ HP OBB motor. First boiler and stoker available first week in May. Second one sixty days later.

S. B. FOOT TANNING CO.
RED WING, MINN.

BOILER

Union Iron Works, 535 h.p. horizontal tubular Boiler, 3 drum, A.S.M.E. Code, 199# steam pressure, complete with the following: Superheater, boiler motor, soot blowers, electric eye, coal pulverizer, steel coal bin and bucket conveyor, new 1930, condition good. Sacrifice for quick sale.

Surplus & Salvage Co., Inc.
Jamestown, N. Y.

CENTRIFUGAL PUMP

Ingersoll-Rand 4x2 Size: 2 JVL, 2 Stage, 460 GPM, 520' Head, Hydr. Test 450 direct connected to 100 HP GE 3/60/220-440-3560 RPM Motor #378 Stainless Steel Head in excellent condition $800.00 fob.

ALLIED MATERIALS HANDLING CO.
4657 Spring Grove, Cin'ti 32, Ohio

DYNAMOMETER FOR SALE

900 HP Midwest Dynamatic Dynamometer, 250 Volts, 1500-3300 RPM, Type 2025-W, Serial No. 2208. Unused w/Toledo Scale, Controls, Etc.
PRICE **$2,750.00**

PRACTICALLY NEW

WINSTON MACHINERY CO., INC.
517 South Delaware St., Indianapolis 4, Indiana

FOR SALE

1—Skinner Uniflow Engine, 150 to 8 pounds pressure, direct connected to Electric Machinery Alternator 480/3/60.

THE C. H. NORTON CO.
North Westchester, Conn.

An Investment!

Productive advertising is an INVESTMENT rather than an EXPENDITURE.

"Searchlight" advertisers almost invariably report prompt and satisfactory results.

BE CONVINCED — send us your advertisement TODAY.

Address
Classified Advertising Division

POWER
330 W. 42nd St., N. Y. 18, N. Y.

SLIP RING MOTORS 3-Ph., 60 Cy.

HP	Volts	Make	Speed
450	440/220	Whse.	514
250	2200/440	Whse.	600
200	440/220	Whse.	514
200	440/220	Whse.	900
200	2300/440	G.E.	1200
200	440	G.E.	450
150	440/220	Whse.	600
150	440/220	Whse. (2)	1800
150	2300/440	G.E.	1200
150	440/220	G.E.	720
100	440/220	G.E.	600
100 (2)	440/220	Whse.	900
100	2200/550	G.E.	1500
80	440/220	G.E. (MTC)	900
75	2200/550	G.E.	1800
75	440/220	Whse. 25 cy.	750

SYNCHRONOUS MOTORS 3-Ph., 60 Cy.

HP	Volts	Make	Type	RPM
400	440/220	G.E.	ATI	600
300	2200/440	G.E.	TS	720
300	440/220	G.E.	ATI	600
250	440/220	Whse.	HR	277
250	440/220	G.E.	ATI	600
250	4800/2300	El. Mchy.	Syn.	600
240	2300/440	G.E.	ATI	720
200	440/220	G.E.	TS	720
200	4150/2300	Whse.	G	1800
120	440/220	G.E.	ATI	900
110	440/220	G.E.	TS	257
100	440/220	Whse.	G	1800
75	2200/440	Whse.	GE	600

GENERATOR SETS

1—62½ kva. 1200 rpm. 220 volt. Whse., geared to 7300 rpm. Whse., non-cond. steam turbine, 150 lbs. pr.
2—unused 25 kva. 120/280 v., 3 ph., 1200 rpm. generator dir. conn. to Waukesha 6 cyl. gas engine

AIR COMPRESSOR UNIT

1—17" and 8" by 10" Worthington FEATHER-VALVE. 285 rpm. 110 lbs. gs. motor-driven.

CIRCUIT BREAKERS

2—2000 amp., GG E. 3 pole, 600 v., air
3—1600 amp., ITE, 3 pole, 600 v., air
2—1200 ampere, Whse., 3 pole, 600 v., air

SQUIRREL CAGE MOTORS

HP	Volts	Make	Type	Speed
650	440	G.E.	FT	3600
500	440/220	G.E.	IK	900
350	2200	G.E.	KT	1200
300	2200	G.E.	KT	1800
250	2200/440	L. Allis	OGS	1200
200	440	G.E.	IK	514
200	440/220	Whse.	CS	1200
200	440/220	G.E.	KT	1800
200	2200/440	G.E.	KT	720
200	2200/550	Cr. Wh.	SC	900
200	2200/440	G.E.	KT	1200
200	440/220	G.E.	IK	450
150	440/220	G.E.	IK	450
100	2200/550	Whse.	CS	900
150	440/220	G.E.	KT	720
150	440/220	Howell	B. Brg.	1800
150 vert.	440/220	G.E.	KTF	1200
150	440/220	G.E.	IK	514
150	440/220	Whse.	CS (NEW)	900
150	440/220	G.E.	KT	1200
125	440/220	G.E.	KT	720
100	2200/440	G.E.	K	1200

A. C. GENERATORS

1—320 kva, 600 rpm, 2300/440/220 V., G.E.
1—250 kva, 720 rpm, 2300/440 v., G.E.
1—225 kva, 600 rpm, 220/440 v., G.E.
1—225 kva, 720 rpm, 2300/440 v., G.E.
1—150 kva, 900 rpm, 480/240 v., G.E.
3— 75 kva, 1800 rpm, 480/240 v., Whse.

D. C. MOTORS

HP	Volts	Make	Type	Speed
350	230 (2)	G.E.	CD	1150
250	230 (3 new)	Cr. Wh.	CMC	1800
200	230	Cr. Wh.	CMC	890
150	230 (new)	Cr. Wh.	TSFC	900
100	230	Cr. Wh.	CMC	625
100	230	G.E.	CD	1750
75	230	G.E.	CD	1150
75	230	Whse.	SK	850

MOTOR GENERATOR SETS

1—300 kw. 1200 rpm, 250 v., G.E., connected to 500 hp. 1200 rpm, 2300/440 v., synchronous
1—165 kw. 1200 rpm, 240 v., G.E., conn. to 250 hp. 1200 rpm, 440/220 v., squirrel cage
1—125 kw. 1200 rpm, 250/120 v., G.E., conn. to 175 hp. 1200 rpm, 4000/2300/440 v., synchronous
1—100 kw. 250 v., Hertner, 1200 rpm, connected to 150 hp. 2200/440 v., synchronous
1—80 kw. 1200 rpm. 250 V., G.E., connected to 125 hp 2200/440 V. squirrel cage motor
1—75 kw. 125 v., 1200 rpm, G.E. conn. to 130 hp. 2300/440 v., syn. motor.

TRANSFORMERS 60 Cy.

3—667 kva, Whse., 33,000—2300 V.
3—333 kva, G.E., 13,200—2300 V.
3—333 kva, Whse., 4800/2400—240/480 V.
3—250 kva, G.E., 6900/13,800—230/460 V.
3—200 kva, Whse., 13,200—2300 V. (Inserteen)
3—150 kva, G.E., 2400—240/480 V.
6—150 kva, Al. Chal. 2400—240/120 v.
1—150 kva, Whse. SK, 13200-125/215 v., 3 ph
3—100 kva, G.E., 4600/2300—230/460 V.
3—100 kva, G.E., 13800—230/115 v., NEW
6—100 kva, G.E., 4600/2300-230/115 v., NEW
3—100 kva, G.E., 450-115/230 v., dry, 1 ph. new
2—75 Kva, G.E., 440—240/120 v. Pyranol
3—50 kva, G.E., 480—240/120 V., Pyr

STEPHEN HALL & CO.

HARRY J. RICE PRES.

458 SEVENTH ST. HOBOKEN, N. J.

One of the best buys we have offered Save at least 75%

INSURED BOILERS

4 ea. Hedges-Walsh-Widener Cross Drum Water Tube; built 1934; 350# WP 3904 HS plus superheaters; Triple-riveted Built for 200% rating

Inspected by insurer recently Insured until May 1950

2 ea. Kewanee 275 HP, 30# WP boilers FOR HEATING PURPOSES—Sacrifice for immediate sale. Built 1942 gas fired, with all fittings. *Like new.*

STOCKYARD IRON CO.
1208 Penn Memphis, Tenn.

TRANSFORMERS

FOR SALE

2— 150 KVA. 60 CY. 1 PH. 2400-240/480 SCOTT TAPS.
6— 100 KVA. 60 CY. 1 PH. 2400-240/120.
3 75 KVA. 60 CY. 1 PH. 2400-240/120.
9— 50 KVA. 60 CY. 1 PH. 2400-240/120.
7—37½ KVA. 60 CY. 1 PH. 2400-240/120.
8— 15 KVA. 60 CY. 1 PH. 2400-480/240.

ALSO ALL TYPES OF AIR COOLED AND PHASE CHANGERS.

ATLANTIC TRANSFORMER CO.
5143 N. 2nd St. Philadelphia 20, Pa.

WANTED

WANTED

Steam Turbo Unit 4000-5000 KW Marine Type 150 or 200 HP mtr. 3 ph., 60 cy., 720 or 900 RPM 33,000 Volt Transformers.
Circuit Breakers 7500 volts 100,000 KVA interrupting capacity or greater.

RM. 4200, 316 SOUTH LaSALLE ST.
CHICAGO 4, ILLINOIS

TRANSFORMERS WANTED

WANTED—Indoor fire proof oil cooled transformers similar to Pyranol or Askerol in sizes 500 to 1000 KW—4160 volts primary to 480 volts secondary—with or without switchgear. Will also consider air cooled. Write giving full information, specifications and prices. *Reply*

W2490 POWER
520 N. Michigan Ave., Chicago 11, Ill.

WANTED A.C. MOTORS

FOR CASH

ALL SIZES 1 to 300 HP
SEND LISTING — COMPLETE DESCRIPTION

Industrial Electric & Supply Co., Inc.
Box 1398—Memphis, Tennessee, Dept. A

WANTED

Turbo-Generator Unit, non-condensing 245-290 psig saturated inlet, 80-90 psig exhaust with back-pressure control. Approx. 1500 Kw.; 4160/2300 volt, 3 ph., 60 cy., 80-90% p.f. Switchgear required also. What have you?

J. BISHOP
CENTRAL HEATING PLANT
University of Florida, Gainesville, Fla.

BUYERS OF SURPLUS COPPER INSULATED WIRES AND CABLES

No lengths too long or too short
TELEPHONE: EASTGATE 7-4778

PIERCE CABLE CO.
2668 CLYBOURN AVE., CHICAGO 14, ILLINOIS

Air Compressors Wanted

Horizontal Water Cooled—Any size also 2 Stage portable unit

L. W. BAUER
North Bergen, N. J.

ADVERTISERS' INDEX

This index is a service to readers. Every effort is made to maintain its accuracy, but POWER cannot assume responsibility for errors or omissions. When a star appears after the name, the advertisement does not appear in this issue but appeared in an issue within the previous three months.

Aerotec Corp. ... 247
Air-Maze Corp. ... *
Air Preheater Corp. ... 217
Air Express Div.
Railway Express Agency ... 178
Allen-Sherman-Hoff Co. ... *
Allis-Chalmers Mfg. Co. ... 41, 49, 55, 167
American Blower Co. ... 244
American Brass Co. ... 133
American Chain & Cable Co. ... 189
American Chimney Corp. ... 292
American District Steam Co. ... *
American Engineering Co. ... 251
American Pulverizer Co. ... 256
Anchor Packing Co. ... 171
Arkansas Fuel Oil Co. ... 203
Armstrong Cork Co. ... 181
Armstrong Machine Works ... 137
Atlas Valve Co. ... *
Aurora Pump Co. ... *

Babbitt Steam Specialty Co. ... 228
Babcock & Wilcox Co. ... 4-5
Babcock & Wilcox Tube Co. ... *
Badger Mfg Co. ... 290
Bailey Meter Co. ... 12-13
Baldwin-Hill Co. ... *
Baltimore & Ohio Railroad ... 273
Beaumont Birch Co. ... 220
Bell & Gossett Co. ... *
Belmont Packing & Rubber Co. ... *
Bernitz Furnace Appliance Co. ... *
Betz Co., W. H. & L. D. ... 129
Biddle & Co., James G. ... *
Bigelow Company ... 194
Birch Mfg. Co. ... 292
Bird-Archer Co. ... *
Black, Sivalls & Bryson, Inc. ... 168-169
Blaw-Knox Co. ... *
Boiler Tube of America ... 230
Bowser, Inc. ... *
Bridgeport Brass Co. ... 283
Brown Boveri Corp. ... 285
Buell Engineering Co. ... 277
Buffalo Forge Co. ... 34
Buffalo Pumps, Inc. ... 266
Burgess-Manning Co. ... 270
Bussmann Mfg. Co. ... 50-51
Byers Co., A. M. ... 74

Canton Stoker Corp. ... 272
Cardox Corp. ... 188
Carey Mfg. Co., Philip ... 208
Cash Co., A. W. ... 252
Catawissa Valve & Fittings Co. ... 230
Chapman Valve & Mfg. Co. ... 155
Chase Brass & Copper Co., Inc. ... 241
Chelsea Fan & Blower Co., Inc. ... 294
Chicago Metal Hose Corp. ... 284
Chicago Pneumatic Tool Co. ... 293
Cities Service Oil Co. ... 203
Clarage Fan Co. ... 213
Clark Mfg. Co. ... *
Cleaver-Brooks Co. ... *
Clipper Mfg. Co. ... 239
Cochrane Corp. ... 28-29

Coffin, Jr., Co., J. S. ... 180
Combustion Engrg.-Superheater, Inc. ... 22-23
Condenser Service & Engrg. Co. ... 242
Copps Engineering Co. ... 161
Crane Company ... 145

Darling Valve & Mfg. Co. ... 276
Dart Mfg. Co., E. M. ... 196
Davis Regulator Co. ... 210
Dearborn Chemical Co. ... 219
DeLaval Separator Co. ... 165
DeLaval Steam Turbine Co. ... 32-33
Detroit Stoker Co. ... 191
Diamond Power Specialty Corp. ... 8-9
Dowell, Inc. ... 157
Dravo Corp. ... 228, 259
Drew Co., Inc., E. F. ... 199

Eagle-Picher Co. ... 185
Eastern Gas & Fuel Associates ... 229
Economy Pumps, Inc. ... *
Edward Valves, Inc. ... 44-45
Electric Machinery Mfg. Co. ... *
Electric Storage Battery Co. ... *
Elgin Softener Corp. ... 245
Elliott Co. ... 6-7
Engineer Co. ... 240
Erie City Iron Works ... 289
Ernst Water Column & Gage Co. ... 292

Fairfield Engineering Co. ... 235
Fairmont Coal Bureau ... 176
Fisher Governor Co. ... 207
Flexitallic Gasket Co. ... 151
Flexo Supply Co., Inc. ... 294
Fluor Corp., Ltd. ... *
Foster Engineering Co. ... 233
Foster Wheeler Corp. ... 14-15, 46-47
Foxboro Co. ... 204
Frick Co. ... *
Fuller Co. ... *

Garlock Packing Co. ... *
General Electric Co.
(Apparatus Dept.) ... 10-11, 35-36, 42-43, 153, 238
Globe Steel Tubes Co. ... 195
Golden-Anderson Valve Spec. Co. ... 289
Goodyear Tire & Rubber Co. ... *
Gorman-Rupp Co. ... 290
Goulds Pumps, Inc. ... 228
Graver Water Conditioning Co. ... 262
Grinnell Co. ... Third Cover
Griscom-Russell Co. ... 48
Gulf Oil Corp. ... 175
Gulf Refining Co. ... 175
Gunite Concrete & Construction Co. ... 232

Hagan Corp. ... 20-21
Hall Laboratories ... 179
Harbison-Walker Refractories Co. ... *
Hays Corp. ... 56-57
Heacon, Inc. ... *
Hendrick Mfg. Co. ... 158
Hensley Co. ... 198
Hewitt-Robins, Inc. ... 182
Hill Pump Valve Co. ... 292
Hoffman Specialty Co. ... *

Homestead Valve & Mfg. Co. ... 264
Honan-Crane Corp. ... 281

Illinois Water Treatment Co. ... *
Industrial Sound Control Co. ... *
Infilco, Inc. ... *
Ingersoll-Rand Co. ... 173
International Nickel Co. ... *
Iron Fireman Mfg. Co. ... 274

Jeffrey Mfg. Co. ... 40
Jenkins Bros. ... 140-141
Jerguson Gage & Valve Co. ... *
Johns-Manville ... 135
Jones Foundry & Machine Co., W. A. ... 246
Joy Mfg. Co. ... 223

Keasbey & Mattison Co. ... 255
Kellogg Co., M. W. ... 52
Kennedy Valve Mfg. Co. ... *
Kennedy-Van Saun Mfg. & Engrg. Corp. ... 26-27
Kewanee Boiler Corp. ... 236
Kieley & Mueller, Inc. ... 177
Kinney Mfg. Co. ... 243
Klipfel Valves, Inc. ... *
Koppers Co., Inc. (Coupling Dept.) ... 187
Kuljian Corp. ... 249

Leeds & Northrup Co. ... Second Cover
Ladish Co. ... 159
Lapp Insulator Co., Inc. ... *
Leslie Co. ... *
Link-Belt Co. ... 3
Littleford Bros., Inc. (Gen. Div.) ... 236
Lockett & Co., Ltd., A.M. ... 238
Lummus Co. ... *
Lumnite Div.
Universal Atlas Cement Co. ... *
Lunkenheimer Co. ... 58-59

Manheim Mfg. & Belting Co. ... *
Manning, Maxwell & Moore, Inc. ... 227
Manzel, Inc. ... 216
Marley Co. ... *
Marsh Corp., James P. ... *
Mason-Neilan Regulator Co. ... 170
Maxim Silencer Co. ... *
McGraw-Hill Book Co. ... 190, 236
Mercoid Co. ... *
Midwest Piping & Supply Co. ... 215
Milton Roy Co. ... 250
Minneapolis-Honeywell Regulator Co.
(Industrial Div.) ... 197, 275
Mitchell & Co., W. K. ... 225
Modine Mfg. Co. ... 258
Monsanto Chemical Co. ... 230
Murray Iron Works ... 212

Nagle Pump Co. ... *
National Airoil Burner Co., Inc. ... 232
National Aluminate Corp. ... 139
National Electric Coil Co. ... *
National Tube Co. ... 268
National Valve & Mfg. Co. ... 288
Niagara Blower Co. ... *
Nicholson & Co., W. H. ... 184

Nordberg Mfg. Co. ... 316
Northern Equipment Co. ... 143
Norton Co. ... •

Oakite Products, Inc. ... 190
Ohio Injector Co. ... 163
Owens-Illinois Glass Co. (Kaylo Div.) ... 271

Pacific Pumps, Inc. ... •
Paraffine Companies, Inc. ... 164
Peabody Engineering Co. ... •
Peerless Pump Div.
Food Machy & Chemical Corp. ... 260
Pennsylvania Crusher Co. ... •
Penn Flexible Metallic Tubing Co. ... •
Permutit Company ... 65
Petro-Chem Development Co., Inc. ... 232
Philadelphia Gear Works ... 183
Pipe Fabrication Institute ... •
Pittsburgh Lectrodryer Corp. ... •
Pittsburgh Piping & Equipment Co. ... 291
Pittsburgh Steel Co. ... 237
Plibrico Jointless Firebrick Co. ... •
Powell Co., Wm. ... 62-63
Power Co., Inc., Edward M. ... 220
Powers Regulator Co. ... 30-31
Prat-Daniel Corp. ... 64
Preferred Utilities Mfg. Co. ... 286
Pritchard & Co., J. F. ... 232

Raybestos-Manhattan, Inc.
Packing Div. ... 279
Reading, Pratt & Cady Div. ... 189
Reliance Gauge Column Co. ... 257
Republic Flow Meters Co. ... 68-69
Republic Rubber Div.
Lee Rubber & Tire Co. ... 280
Republic Steel Corp. ... 38-39
Research Corp. ... •
Revere Copper & Brass, Inc. ... 146-147
Richardson Scale Co. ... 214
Ric-Wil Co. ... 205
Riley Stoker Corp. ... 108-109
Rohm & Haas Co.
(Resinous Prod. Div.) ... •
Ross Heater & Mfg. Co. ... 282
Roto Div. of Elliott Co. ... 162

Sante Fe Tank & Tower Co. ... 238
Sarco Co. ... 67
Sauerman Bros., Inc. ... 238
Schutte & Koerting Co. ... 131
Shaw Co., B. F. ... 123
Sier-Bath Gear & Pump Co. ... •
Simplex Valve & Meter Co. ... •
Sinclair Refining Co. ... •
Skinner Engine Co. ... 200
Smith Corp., Winfield H. ... 192
Smith Refractories, Sanford S. ... •
Socony-Vacuum Oil Co. ... •
Sparkler Mfg. Co. ... 160
Spence Engineering Co., Inc. ... 60-61
Springfield Boiler Co. ... •
Standard Oil Co. of Indiana ... 110A-110B
Standard Stoker Co., Inc. ... 206
Steel & Tubes Div. ... 38-39
Stephens-Adamson Mfg. Co. ... 37
Stickle Steam Specialty Co. ... •
Stock Equipment Co. ... 172, 184
Stone & Webster Engrg. Corp. ... •
Strong, Carlisle & Hammond Co. ... 174
Struthers Wells Corp. ... 231
Sturtevant Div.
Westinghouse Electric Corp. ... •
Sun Oil Co. ... 127
Superior Combustion Industries ... 193
Swartwout Co. ... 149
Sweet's Catalog Service ... •

Taylor Forge & Pipe Works ... 287
Taylor Instrument Co's ... 247
Terry Steam Turbine Co. ... 221
Texas Co. ... Back Cover
Thermix Corp. ... 64, 247
Tidewater Associated Oil Co. ... 209
Timken Roller Bearing Co. ... 234
Todd Shipyards Corp.
Combustion Equipment Div. ... •
Toledo Pipe Thread. Mach. Co. ... 218
Topflight Tape Co. ... 292
Tri-Lok Co. ... 228
Troy Engine & Machine Co. ... 202
Trumbull Electric Mfg. Co. ... 248
Tube-Turns, Inc. ... 201

Union Iron Works ... 224
U.S. Steel Corp. ... 268

Viking Pump Co. ... 198
Vogt Machine Co., Henry ... 254
Vulcan Soot Blower Corp. ... 24-25

Wallace & Tiernan Products, Inc. ... •
Walworth Co. ... 70
Warren Steam Pump Co. ... 263
Watson-Stillman Co. ... 222
Western Chemical Co. ... 166
Westinghouse Electric Corp. ... 16-17, 72-73
Weston Electrical Instrument Co. ... 186
Wheeler Mfg. Co., C. H. ... 265
Where to Buy ... 292
Wickes Boiler Co. ... 253
Wiedeke Co., Gustav ... •
Wilmot Engineering Co. ... 226
Wing Mfg. Co., L. J. ... •
Worthington Pump & Machy Corp. ... 66, 211
Wright Chemical Co. ... •

Yarnall-Waring Co. ... 18-19, 125
Youngstown Sheet & Tube Co. ... 261

Zallea Bros. ... •

Professional Services ... 292

SEARCHLIGHT SECTION

(Classified Advertising)

EMPLOYMENT
Positions Vacant ... 295
Selling Opportunities Offered ... 295
Positions Wanted ... 295
Selling Opportunities Wanted ... 295
Employment Services ... 295

EQUIPMENT
(Used or Surplus New)
For Sale ... 295-313

WANTED
Equipment ... 313

ADVERTISERS INDEX
Aljohn Diesel Co., Inc. ... 306
Allied Materials Handling Co. ... 312
American Air Compressor Corp. ... 302
American Coal Burner Co. ... 295
American Electric Service & Maintenance Co. ... 311
Arrow Transformer Co., Inc. ... 305
Atlantic Transformer Co. ... 313
Automatic Combustion Equip. Co. Inc. ... 310
Bauer, L. W. ... 313
Belyea Co., Inc. ... 306
Bishop, J. W. ... 313
Boswick Electric Co., The ... 302
Brearley H. P. ... 306
Brew, Woltman & Co., Inc. ... 310
Chicago Electric Co. ... 307
Cimco ... 306
Darien ... 310
Delta Equipment Co. ... 304
Douglas Co., Stephen A. ... 312
Duquesne Electric & Mfg. Co. ... 305
Eastern Machinery Co., The ... 303
Ebasco Services Inc. ... 308
Electric Apparatus Repair Co. ... 303
Electric Equipment Co. ... 302
Electric Generator & Motor Co. ... 303
Electric Service Co., Inc. ... 300
Electronicraft Inc. ... 307
Ellis Co., A. Lee ... 306
Empire Electric Co., Inc. ... 307
Erie Electric Co., Inc. ... 311
Foot Tanning Co., S. B. ... 312
Glow Electric Co. ... 296
H & P Machinery Co. ... 308
Hall & Co., Stephen ... 313
Heat & Power Co., Inc. ... 312
Hemphill & Co., J. L. ... 297
Hercules Elect. Machy & Equip. Co. ... 305
Hobson & Sons, Russell B. ... 305
Industrial Electric & Supply Co., Inc. ... 313
International Power Machinery Co. ... 301
Johnson & Associates, Howard B. ... 300
Kirk Co., Wallace E. ... 303
Land, Inc., L. J. ... 304, 309
MacCabe Co., T. B. ... 309
Meadow Gold Products Co. ... 295
Merrill & Co. ... 310
Mississippi Valley Equipment Co. ... 303
Moulton, Wm. C. ... 304
National Boiler & Equip. Co. ... 306
Newman & Co., Inc. ... 304
Northern Metal Co. ... 302
Norton Co., The C. H. ... 312
O'Neill, A. J. ... 303
Penn. Machinery Co. ... 305
Pharma Chemical Corp. ... 300
Pierce Cable Co. ... 313
Power Plant Equipment Co., Inc. ... 312
Powerite Corp. ... 306
Purity Bakeries ... 306, 311
Rearick Chas. B. ... 304
Saxony Mills ... 312
Schoonmaker Co., Inc., A. G. ... 300
Standard Oil Development Co. ... 310
Stanhope, L. M. ... 300
Stockyard Iron & Metal Co. ... 311, 313
Stultz Electric Works ... 295
Superior Equipment Co. ... 304
Surplus & Salvage Co., Inc. ... 312
Thompson Co., Inc., J. Parker ... 305
Tomsett Associates ... 295
Universal Wire & Cable Co. ... 303
Utilities Machinery Corp. ... 306
Wagner Co., Arthur ... 298
Weaver, Charles ... 299
Wente Electric Co., The ... 308
Western Regulator Exchange ... 295
Winston Machinery Co., Inc. ... 312
Wisconsin Iron & Metal Co. ... 307

BRYAN, OHIO pioneer user of Diesel Power

Two of the four Nordberg Diesels at Bryan are shown in this view . . . the 9-cylinder, 3600 hp unit and part of the 8-cylinder, 3200 hp unit.

. . . another plant that is 100% NORDBERG POWERED

Up until 1907, the municipal plant at Bryan, Ohio used conventional steam power. But that year Bryan made news by being one of the first municipalities to adopt Diesel Engines for power generation. In the ensuing forty-three years, the use of Diesels at Bryan was steadily increased. It is significant that this pioneer Diesel user gradually replaced the older Diesel and steam units with *Nordberg* Diesels, until today it is an *all-Nordberg* powered plant.

Built in sizes from 10 H.P. to 8500 H.P., in a wide range of gas and oil burning types, Nordberg Diesels offer dependable power at low operating cost to meet almost all municipal and industrial needs. Write for further details, outlining your requirements.

NORDBERG MFG. CO., Milwaukee 7, Wis.

BRYAN'S RECORD OF PROGRESS

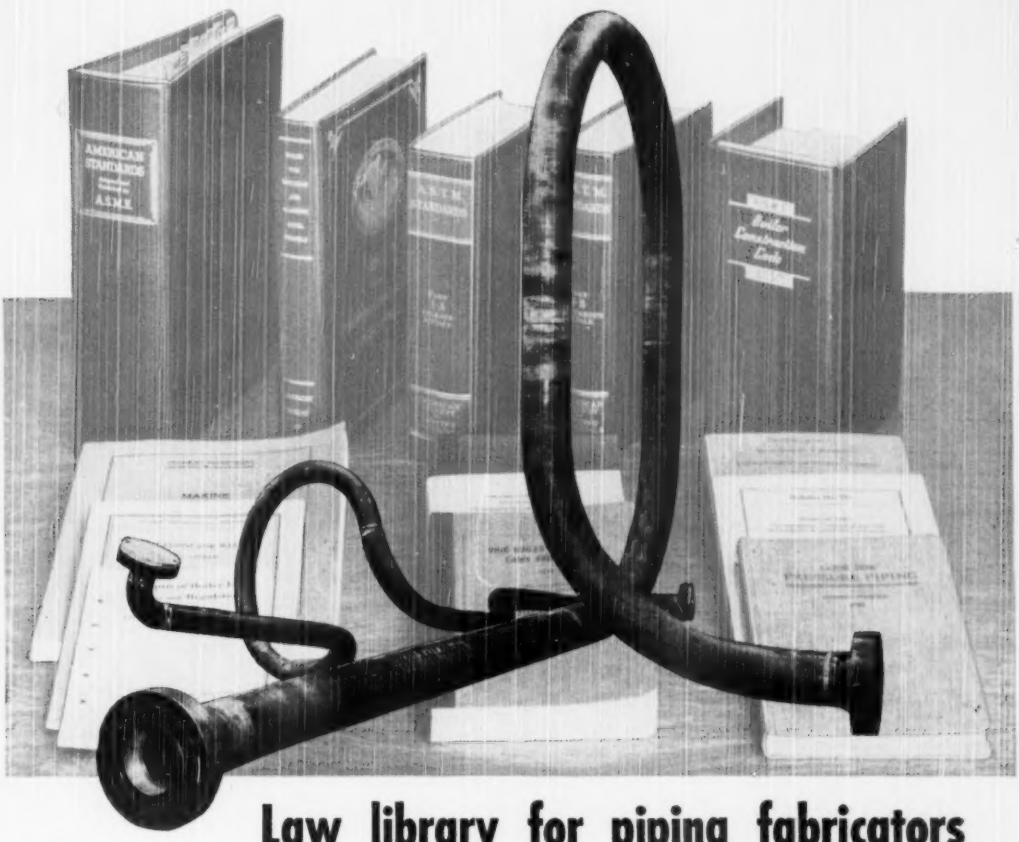
1907	—Installed two 225 hp American Diesel Engine Company* Diesels and abandoned steam generating equipment
1911	—Added a 450 horsepower Lyons Atlas Diesel
1916	—Installed 520 horsepower Busch-Sulzer Diesel
1933	—Installed their first Nordberg —a 1500 horsepower unit
1934	—Added their second 1500 horsepower Nordberg
1939	—Installed a 3200 horsepower Nordberg Diesel
1946	—Installed their fourth Nordberg Diesel . . . a 3600 horsepower unit

**American Diesel Engine Company later became Busch-Sulzer, now a division of Nordberg*

P35

BUSCH-SULZER

NORDBERG DIESEL ENGINES



Law library for piping fabricators

THE safety of your employees, the welfare of the community and a major investment can depend on a single piece of prefabricated piping. That's what piping codes are for . . . state, national, association and insurance codes. You don't have to know these codes because Grinnell engineers know the "law" intimately, check and cross-check with these codes at every step from preparation of detailed drawings and specifications right through bending, welding, stress relieving, heat treating, testing, final inspection, assembly and test runs.

That's just one of the many advantages of having a piping system prefabricated by Grinnell.

The complete "package" includes interpretative engineering, metallurgical research, compliance with code requirements, manufacturing drawings and specifications, production schedules, purchase of materials, specialized facilities, skilled personnel, control of quality and rigid inspection.

You get this complete package from a Grinnell prefabricated piping plant on schedule, ready for field erection, meeting all code requirements and at a real economy.

100th ANNIVERSARY
WHEREVER PIPING IS INVOLVED

GRINNELL

Grinnell Company, Inc., Providence 1, R.I. Warehouses: Atlanta • Buffalo • Charlotte • Chicago • Cleveland • Cranston • Fresno • Kansas City • Houston • Long Beach
Los Angeles • Milwaukee • Minneapolis • New York • Oakland • Philadelphia • Pocatello • Sacramento • St. Louis • St. Paul • San Francisco • Seattle • Spokane

DIESELS RUN CLEANER...

...and fuel costs are less when you lubricate with Texaco Ursa Oils

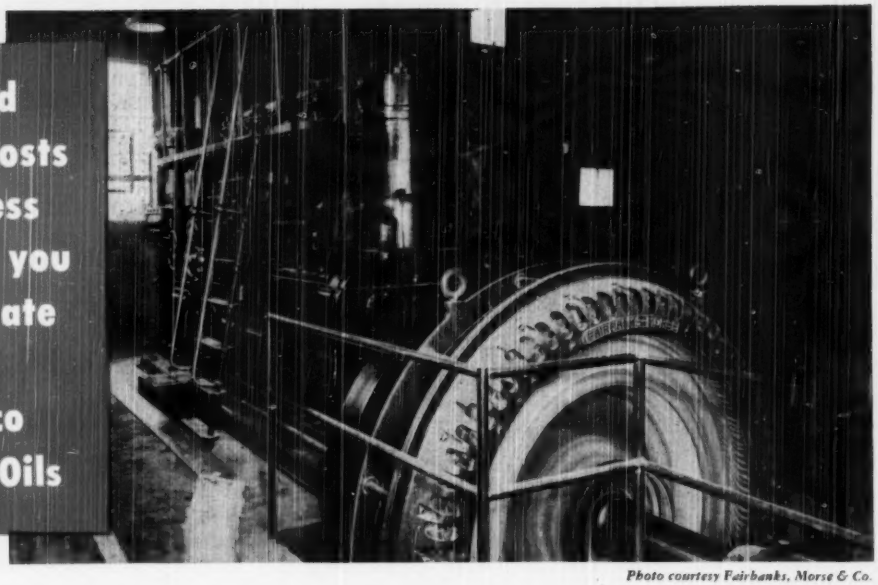


Photo courtesy Fairbanks, Morse & Co.

ANY Diesel lubricated with *Texaco Ursa Oil* is bound to run cleaner because *Texaco Ursa Oils* have high resistance to oxidation . . . and are designed to keep harmful carbon, sludge and varnish from forming. So rings stay free, valves work the way they should, ports stay open . . . assuring better compression and combustion.

In addition, *Texaco Ursa Oils* maintain their tough lubricating films in spite of heat and high pressure. Wear all but vanishes. Bearings and all moving parts last longer. No wonder maintenance costs and fuel consumption are less when *Texaco Ursa Oils* are on the job!

There is a complete line of *Texaco Ursa Oils*. They are approved by leading Diesel manufacturers, and are easily America's favorite Diesel lubricants — as shown by the fact that *more stationary Diesel h.p. in the U. S. is lubricated with Texaco Ursa Oils than with any other brand.*

Get a greater return from your Diesel operating dollar. A Texaco Lubrication Engineer will gladly help you. Just call the nearest of the more than 2,000 Texaco Wholesale Distributing Plants in the 48 States, or write:

The Texas Company, 135 East 42nd Street, New York 17, N. Y.

TEXACO

TEXACO Ursa Oils

FOR ALL DIESEL ENGINES

TUNE IN . . . TEXACO STAR THEATER starring MILTON BERLE on television every Tuesday night. See newspaper for time and station.